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ATOMIC SCIENTISTS

A MAGAZINE FOR SCIENCE, PUBLIC AFFAIRS, AND EDUCATION

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Special Issue on:

CIVIL DEFENSE *AGAINST* ATOMIC ATTACK

The BULLETIN of the

ATOMIC SCIENTISTS . . . .

WHEN the bomb fell on Hiroshima it broke a six-year silence which security had imposed on the atomic scientists. It also shattered the scientists' "ivory tower" of detachment from the social and political implications of their discoveries. For the scientists—who had six years to consider the implications of atomic warfare before these implications exploded on a stunned world—recognized that they had a responsibility to see that this force would be used for the benefit and not the destruction of mankind.

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CIVIL DEFENSE: THE LONG-RANGE VIEW

Eugene Rabinowitch
Editor of the Bulletin
Professor in the Graduate School,
University of Illinois

THE *Bulletin* owes its existence to the conviction of the scientists that the invention of atomic weapons has made another total war the suicide of civilization. Why, then, does it now devote almost a whole issue to discussions of the "civil defense" against atomic attacks? Did the scientists not say, once and for all, that "there is no defense?"

The phrase "there is no defense" meant that, contrary to popular illusions, no specific counter weapon can be expected which will prevent atomic bombs from exploding or cause them to explode prematurely, or enable cities to withstand atomic explosions without crumbling into dust.

The possibility of two types of measures to decrease the destructive effect of an atomic attack was, however, never denied: (1) *Interception* of bomb carriers, which, as things stand now, can at best reduce markedly the number of carriers reaching their targets, but cannot be expected to provide 100 per cent, or even 50 per cent protection; and (2) "civil defense," meaning evacuation, protection, and first-aid measures which could reduce the number of casualties of a bomb hit on a city—say from one hundred thousand to thirty or fifty thousand, and (what is even more important) could attenuate considerably the crippling effect of an atomic attack on the capacity of the nation to support a war effort.

* * *

Five years ago, at the first meeting of the group which later became the "Atomic Scientists of Chicago," four measures were proposed for discussion: (1) International control of atomic energy; (2) World Government; (3) Union of democracies; and (4) Dispersal of cities.

The first three were—and remain—alternative rational answers to the threat which atomic war poses to mankind. The fourth was—and remains—the only fully effective means of reducing the consequences — and thus the likelihood—of an atomic attack, if rational attempts to make it impossible prove futile. "Civil defense," as envisaged now, falls far short of what a general dispersal of cities would achieve —namely, depriving the enemy of worthwhile targets for atomic bombardment. Nevertheless, it can reduce to a certain degree the damage to people, industry, and transportation, which an atomic attack would otherwise cause, and this can make such an attack less tempting.

* * *

As anticipated five years ago, the atomic bomb has not remained an American monopoly for more than a few years, and a stockpile of these bombs is now being accumulated by the Soviet Union. Negotiations for international control of atomic energy have bogged down in the muddy battlefields of the cold war. World Government is as yet but an article of faith of a growing, but powerless *avant guarde* of world political opinion. The movement toward a Federal Union of Democracies has fared somewhat better; the ECA, the Atlantic Union, and the Council of Europe have been steps in this direction which have taken us considerably beyond the primitive stage of a military alliance. However, this advance, too, has been slow, and it is not likely that it will lead, before it is too late, to that extreme "unbalance of power" in favor of the democratic nations, in which Mr. Urey (among others) has hoped to find a safeguard of peace. The fourth point on the initial agenda of the Atomic Scientists—the reduction of our vulnerability to atomic attack—must now be faced as a problem of practical policy.

When the subject was first broached in 1945, some argued that to begin reducing the vulnerability of American cities to atomic attack would reveal that American political leaders expect atomic war, and thus detract from the effectiveness of policies directed toward international control of atomic energy and the outlawing of atomic weapons. The advice not to prepare for war lest you invite it was not especially convincing then and is even less convincing now. Since 1945 America and its friends in Western Europe have belatedly realized that they gave away their best chance of ensuring durable peace when they failed to maintain their wartime military strength until a complete settlement with the Soviet Union had been reached—including her integration into a truly effective international security organization capable of ensuring general disarmament and the international control of atomic energy.

Because this chance was missed, relations with the Soviet Union have become more and more strained, until now, few will deny the validity, in the present situation, of the so often misused rule *si vis pacem, para bellum*. True, military preparations by his adversaries have never yet *prevented* a conqueror from resorting to war; there is, for example, little doubt that sooner or later, Hitler would have used force to achieve his expansionist aims, even if England and France had prepared for war much more effectively than they did before 1939. Preparedness alone will not preserve peace indefinitely; but preparedness has, in the past, *delayed* aggression, while lack of preparedness has precipitated it. The same remains true now. If a long breathing pause could be obtained and used, with political wisdom and imagination, to create permanently effective instruments for the preservation of peace, mankind might yet be spared the ultimate calamity of a third world war fought with atomic weapons.

* * *

At present, two deterrents make the outbreak of a general war unlikely. One is the incapacity of the Soviet Union to stage an attack on the American arsenal of war production equal in effectiveness to the attack America could deliver against the Soviet war potential. This inequality restrains the Soviet leaders. The other deterrent is the incapacity of the Atlantic nations to defend Western Europe against Soviet invasion and occupation. This restrains those Americans who might feel the desire for coming to grips with the true instigator of aggression, instead of fighting his stooges. The greatest danger for us lies in the fact that the Soviet Union can overcome her inequality in atomic weapons (thus removing the present restaint upon her aggression) more quickly and more certainly than Western Europe can overcome her disparity in armed strength.

Nothing less than the danger of defeat of the democratic West in its power conflict with the communist totalitarianism looms in the possibility that the American atomic threat may be neutralized by the Soviet atomic counter-threat, while the Soviet armed power remains unchallenged in Europe and Asia.

The answer to the second part of this double threat is well recognized—accelerated arming, and continued economic strengthening of Western Europe and of friendly regimes elsewhere. To counteract the first threat is, however, no less important. A partial answer to this danger is, of course, increased production and improvement of our atomic weapons and of the means of their delivery; but, as thoughtful analysts have repeatedly pointed out, the advantage we can gain in this way, will prove to be a paper advantage only, if we fail to reduce the vulnerability to atomic attacks of our industrial cities, harbors, and administrative centers.

We are (and for a few years at least, will stay) far ahead of the Soviet Union in the number of atomic bombs produced and in the means for their long-range delivery. There is, however, no doubt that in the protective measures taken to prevent disruption of production, and crippling of military strength in consequence of a massive atomic attack, the Soviet Union is far ahead of us. It had a much better position to start from, because of its larger area, lesser concentration of population and industry in metropolitan centers, and also because of its present domination (or likely occupation in the case of war) of large industrial areas in Europe, which Americans will be loath to subject to atomic destruction—even under the desperate pressure of war.

The Soviet civil defense organization —the Osoviakhim—had many millions of Soviet citizens enrolled and drilled long before 1939. The eastward movement of Soviet industry received strong impetus through the wartime evacuation of factories beyond the Urals; these factories were not returned to their more exposed locations in Western Russia or the Ukraine after the end of the war. The threat of atomic war undoubtedly has been met by the Soviet economic planners—with the ruthlessness of which only a dictatorial regime is capable—by further dispersal of key industrial plants, and forced migration of labor. Concealment of the location of these new plants often has been mentioned as a major cause of Soviet opposition to free-roaming inspection as a mechanism of international atomic energy control. On our side, the concentration of industrial activity in centers such as Buffalo and Niagara Falls, Youngstown and Pittsburgh, Gary and Chicago, has not been seriously challenged. The locations of the few large industrial plants erected during and after the war in the West or in the South, have been well publicized.

Dictatorship and propaganda have conditioned Soviet citizens to patient endurance of discomfort and unquestioned obedience to authorities. Training has assigned to each his place in the ranks of the civil defense army. In America individualism dominates the psychology of the average man, and the natural response of everybody to sudden disaster will be to save himself and his family—and to help his friends and neighbors in a spontaneous and improvised way. Free communications and a free press will make it impossible to isolate a city which has suffered an atomic attack, from the rest of the country, and thus prevent alarm from spreading. It is only realistic to expect that five atomic bombs exploded over five major American metropolitan centers will produce more industrial damage than would be caused by twenty bombs dropped on Soviet cities, and will cause a more dangerous stampede out of the other big cities. Because of this unfavorable situation, even a continued leadership in the production of atomic weapons will not give America the upper hand in the atomic contest. Our only long-term chance lies in matching the Soviet capacity to absorb atomic attack without crippling damage.

* * *

For this, the development of an effective warning and interception system, and the creation of an effective civil defense system are the two major requirements. They are vital elements of an integrated defense policy aimed at *prolonging peace by making aggression unprofitable.*

* * *

If our preparations to weather an atomic attack are to cause the Soviet leaders to change their estimates of what they can achieve by an atomic attack on the United States, the scope, and character of these preparations must be quite different from what they are now, and even from what they were in England in 1940-41. The several articles on civil defense printed in this issue show that in this field (as in many others), we have wasted five precious years. The authoritative people to whom we have turned for contributions can only speak of civil defense in vague terms, and in future tense. An immense gap remains between the well-understood (and often described) extent of the national catastrophe which an atomic attack on the U.S. may produce five years hence, when the Soviet Union will have, in all likelihood, acquired an atomic arsenal of significant dimensions, and the parochial organization which is being planned to deal with it. It seems as if the planning starts with what can be done without too much expenditure and too much dislocation of peacetime big city life, rather than with a realistic estimate of the dimension of the problem.

Such a realistic estimate should start with the premise that unless war breaks out in the next two or three years, the Soviet leaders will prepare, not atomic hit-and-miss attacks on single American cities, but deliver simultaneous blows against a large number of our vital centers—centers whose destruction they can expect to produce a crippling effect on the American war effort. The new element of simultaneity of destruction over the whole area of a city has been repeatedly emphasized in the description of the attacks on Hiroshima and Nagasaki. (Nevertheless, one public speaker said recently that first aid against atomic attack will have to be organized on a "block basis" rather than on a city-wide scale.) This paralyzing effect will be multiplied in a future attack by simultaneous release of several bombs over cities deemed too big to be destroyed by a single one (or by the use of H-bombs, if these should become available), and by simultaneous attacks on a selected list of harbors and industrial centers throughout the nation. The only way to weather such a multiple blow is to prepare and implement in good time a nation-wide plan, providing for the removal from congested centers, and scattering over the country side, of the most crucial war production plants and administrative agencies, and for the elimination of dangerous transportation bottlenecks (such as the Chicago marshalling yards or Soo locks). The plan must also make provisions for orderly evacuation and useful re-employment of millions made homeless or jobless by the destruction of housing units or industrial and commercial establishments. Local civil defense planning will have to be based on such a nation-wide plan.

Only by such a coordinated nation-wide program can we hope to maintain our production on a high level if several major industrial areas were to be suddenly wiped out and to keep open the flow of supplies to our armies and our allies overseas even if the port facil-

ities of New York, Boston, San Francisco, and San Diego, were to be suddenly rendered unusable by radioactive contamination.

* * *

In the discussion of civil defense in America—including several papers printed in this issue—emphasis is laid on reducing the casualties of an atomic attack. This is natural in a humanistic civilization which considers the individual as its highest value. However, the grim reality is that in the case of a massive atomic attack the main problem will be, not how to save the greatest number of lives, but how to prevent the heartbeat of the nation from stopping. Mr. Peter, in his review of the British experience in the last war, makes it clear that a similar attitude was adopted by British leadership under the *blitz;* it was undoubtedly even more ruthlessly enforced in Germany under the allied mass-bombing attacks. Not the death of millions, but the disorganization of industry and transportation, will be the main threat to our survival. In the next war, civilian casualties will be considered in the same light as military casualties have been in past wars: The main concern of a military commander has always been to preserve the fighting ability of his troops—not to save the lives of his soldiers. Civil defense in an atomic war will be a part of the total war effort—a contribution to winning the war, not a means for keeping civilians safe from death, injury, or loss of property, while soldiers decide the outcome of the conflict on distant battlefields—as used to be the case in the "civilized" wars of the nineteenth century.

* * *

Total war is decided by three factors—size and effectiveness of the military establishment; production and transportation which maintain this establishment's supplies; and the labor force (in the widest sense of the word) that operates the plant. Plans for winning on these three fronts must be integrated. The most powerful army, navy, and air force will be useless if the industrial and transportation plant of the nation could be crippled by atomic destruction of its key centers with no substitute on hand. The best industrial plant would become useless the moment it were abandoned by its labor force, or if this labor force were disorganized by the destruction of its homes or lack of vital supplies. Civil defense must derive its policies and methods from a nation-wide plan of maintaining (or restoring, if needs be) war-essential production and transportation, after an atomic onslaught on our industrial cities, harbors, and railroad centers. These paramount objectives should dictate the extent and direction of evacuations to be undertaken before the emergency or after it. They must determine who is to be instructed to leave the stricken areas as fast as possible, and who will be asked (or ordered) to stay—even if it means exposure to discomfort, privation, or danger from radioactive contamination. The necessity of maintaining the country as a living organism will determine priorities in the assignment of monetary funds and scarce materials and labor for civilian protection activities—construction of shelters, organization of hospitals, provision of blood banks—in various parts of the country, or even in various parts of one city.

* * *

Civil defense in the last war meant primarily protection of one's own family, or city block, from blast and fire. Too many see civil defense in an atomic war as the same parochial task—with a Geiger counter added to a pail of sand and shovel as the standard equipment of an air-raid warden. To a certain extent, this will be the case; but to a much greater extent, civil defense will have to be an organized effort of the civilian population as a whole to keep the country as a whole going concern.

* * *

In the last war, civil defense in a town such as Worcester, England, meant organization of men and equipment to alert the town to an impending attack, provision of shelters, assistance to those hurt or buried under debris, and fighting fires. Worcester, England, may have to cope with a similar problem in the case of another war; but the main problem it will face, and the *only* problem which faces Worcester, Massachusetts, and a thousand other cities throughout the United States, is how to carry out its part in supporting the nearest potential target of an atomic attack—which in the case of Worcester, may be Boston, or the New London submarine base, perhaps even New York. The vast majority of cities—and whole states of the Union, as the state of Maine seems to have recognized—will have to be concerned, not with their own protection, but with sending fire fighters, medical teams, and other trained helpers, into whatever disaster area is assigned to them. A major atomic attack will convert millions of survivors into destitute refugees, in need of new homes, of economic assistance, and often of medical or psychological rehabilitation. These hordes will have to be fed and housed, and, what is most important, the displaced manpower will have to be reintegrated into the production effort of the nation—either by rehousing the workers close to their original places of work if these are still usable, or by giving them opportunity to enter essential activities elsewhere.

* * *

Nation-wide planning for civil defense must thus begin with the listing of potential target areas for atomic attack and designation of corresponding reception and rehabilitation areas. The purpose of civil defense activity, and consequently its organization and training, will have to be different in the two regions. In the target areas, emphasis will be on early evacuation of non-essential population, on provision of underground shelters, an effective warning system, fire proofing and fire-fighting services, radiation detection, and so forth. Whatever dispersal of industry, administration, and labor is at all practicable will have to be made in these centers, selecting primarily the most sensitive and irreplaceable production plants, unique equipment, and skilled labor force. It would be secrecy ill applied if the American defense planners should fail to tell certain cities and nerve centers of the nation that they are prime targets of atomic attack and that their defense is a matter of high national priority; and others that their chance of being attacked is small, or that their civil defense cannot be given a high place in nation-wide planning. Such an announcement will not tell the Soviet leaders anything they do not know, and will provide a realistic basis for local defense planning. However overwhelming the danger of atomic attack may be, it has at least one advantage from the point of view of civil defense: You do not have to plan to defend every factory town, or every hamlet situated close to a railroad junction—not even every city of 100,000 population. Instead, you can concentrate at least for some time to come on a relatively small number of major targets. High ranking of a city on the list of targets can be due either to the sheer accumulation of various industrial plants, or to the unique importance of certain installations located in it—such as the U-235 separation plants at Oak Ridge, or the locks in Sault St. Marie.

* * *

It will not be enough for the national defense planners to tell a city

that it is a primary target for atomic attack, that its civil defense should therefore be tackled with the greatest urgency, and that it will be given high priority in federal assistance. To plan its civil defense properly, a city must also know what kind of attack it may face and what aim—apart from the obvious one of saving lives—its defense is intended to achieve. Estimates must be made of the damage which will be produced in a given target, by one, two, or more atomic bombs exploded in the various possible ways—in the air, on the ground, or under water. Secrecy must be lifted from information vital for planning civil defense—such as what an underwater blast could do to New York, Chicago, or San Francisco. (The depth of the San Francisco Bay and the shallowness of offshore Lake Michigan may make all the difference in the danger to the two cities from this type of attack—but have the mayors of Chicago and San Francisco been warned about it?)[1] Starting with realistic estimates of the bomb effects on a specific target, and taking into consideration the national importance of the different industrial and other activities located in the target and the possibilities of moving or duplicating them elsewhere, decisions will have to be made whether the civil defense authorities of a given target area should concentrate on dispersing its vital activities, or on protecting them in the present location; whether, in case of an explosion of a certain kind, the city should be given up and efforts turned to re-housing and re-employing its survivors elsewhere, or whether the uniqueness of certain facilities, and the impossibility of relocating or duplicating them, will require all efforts to be bent toward resuming this activity in its original location. In the latter case, drastic provisions will be needed to prevent the labor force from abandoning the stricken place despite all possible dangers and discomforts. To alleviate these, ample sheltering should be provided in advance; emergency housing units could be stockpiled in places from which they could be rushed to replace destroyed homes; large-scale decontamination facilities to cope with residual radioactivity could be provided; fire lanes could be established to limit conflagrations; and "earthquake-proof" building standards could be enforced. Here are two concrete examples: An atomic explosion in the air high over lower Manhattan would devastate the garment district; conceivably, the civil defense of this part of New York City will have to be geared to the evacuation and abandonment of this district in case of such an attack, and plans made for relocation of its activities elsewhere. (It would be better if this relocation were carried out *before* the emergency; but the importance to the main war effort, of the activities concentrated in this district conceivably may give it low priority in the necessarily limited national program of relocation.)

An entirely different problem of civil defense would be presented by the possibility of an underwater explosion in San Francisco Harbor. Here, the destruction of buildings will be less extensive, while their relocation—before or after the explosion—appears almost impossible. The vital importance of this harbor for the maintenance of communications with Asia and thus for the flow of supplies to American and Allied forces there, will require the efforts of civil defense to be directed toward keeping the port in operation by all means, despite the blast destruction of many structures and the radioactive contamination of piers and warehouses.

* * *

The cities and villages designated as reception areas will have quite different civil defense tasks depending on their distance from the target areas and their capacities for absorbing and utilizing additional masses of people. Suburban areas of metropolitan centers will have to bear the brunt of providing emergency hospitals, fire fighters, and mobile first-aid units to be sent into the target area; of temporarily feeding and housing thousands, if not millions, of refugees, and of housing permanently those whose places of work in the city have remained usable, but whose homes have been destroyed. More remote regions will have to provide housing and employment to those for whom there is no more work in the destroyed area, as well as offer permanent refuge to children, aged, and those incapacitated by the atomic attack. This kind of civil defense activity, directed toward the benefit of people not belonging to your own family or community, is much less likely to get organized spontaneously than is the case with activities directed toward self-protection. It will need stimulation, encouragement, and planning from national or regional centers.

* * *

If the emphasis on maintenance of productivity, rather than on reduction of casualties, seems to be an inhuman approach, let us remember that the first purpose of preparations to meet an atomic attack, is to *make this attack less likely*. If the Soviet leaders decide to resort to atomic bombardment of American cities, their main concern will not be whether they can succeed in killing one, two, or five million civilians. The question they will ask themselves—and in this they will be no different from military planners in the Pentagon—is whether such an attack can decisively disorganize American production, disrupt transportation, and destroy the political and economic cohesion of the country. We want them to decide that the results will not compensate for the losses to their own industrial power and fighting ability likely to follow our retaliation. For this, we have to impress them with the effectiveness of the measures we have taken to make our capacity for producing and distributing war supplies (and essential civilian supplies) independent of the preservation of a few metropolitan centers—and not with our effectiveness in treating flashburns or radiation sickness. The Soviet Union lost untold millions of civilians in the last war; it has, nevertheless, won through because it has managed to preserve, by ruthless measures, the political and military cohesion of the nation, and to continue and even increase production of war material in plants hastily moved eastward together with their machinery and labor force. The only power in the world the Soviet leaders fear is the power of American production. The chance of crippling this production will be their greatest inducement to use atomic bombs against American cities, as soon as they have accumulated enough of them. By dimming this hope, we will do far more to save millions of American lives than by providing carloads of medical supplies and blood plasma for each city block (however necessary these precautions may be), or by teaching every high-school boy how to use a Geiger counter.

* * *

To sum up: Civil defense on a parochial basis of self-help, directed primarily to the reduction of local damage and casualties, is needed, but a much wider program is needed, too. We do not mean merely providing unifying governmental guidance and federal funds to communities, or of achieving harmonious cooperation and coordination between city, state, and federal authorities. A master plan, analogous to the industrial mobilization plan

[1] According to newspapers, a study of the possible effects of an underwater burst in Boston harbor is being undertaken at the Massachusetts Institute of Technology.

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for war emergency must be prepared. Economic, military, scientific, and political experts of the highest caliber must be called upon to prepare a blueprint for national survival in the case of a massive atomic attack. It must then be decided which parts of this plan require immediate action, and which can be kept as "stand-by" provisions, to be implemented when and if needed—the timing to depend not only on the acuteness of the world-political situation, but also on reliable estimates of the Soviet atomic stockpile, and of the progress toward the production of fusion bombs. Congress must approve this blueprint for "atom-proofing" the American industrial, administrative, and transportation system, and make it an integral part of the over-all armament effort. This program must be considered as no less essential than an expanding atomic bomb arsenal, a 70-group air force, and a 30-division Atlantic Union army; and as deserving, if it needs it (as it probaby would), of expenditures of the same order of magnitude. The central and local civil defense organizations and their specific objectives will have to be shaped to fit this master plan. If, in this way, we succeed in convincing the Soviet leaders that the political, economic, and industrial life of the United States cannot be paralyzed even by a massive atomic attack, this attack may never materialize.

* * *

In all the above considerations we had in mind the danger of an all-out atomic attack after the Soviet Union has acquired a substantial arsenal of atomic bombs. Since the Soviet bomb production is only a year old, this danger is still several years ahead, giving us time to make plans and to carry them out in a fast but orderly way.

What is concerning most people now, and what has caused the sudden increase of public and official interest in civil defense, is, however, a different thing—it is the Korean war and the fear that this war (and its possible successors in the Far and Near East) may lead to a war with the Soviet Union within a few months, or a few years, at the utmost.

If this should be the case, then the Soviet Union, as yet unready to deliver a knock-out blow at American production, will probably prefer that atomic bombs should not be used at all. (This is the motivation behind the tremendous propaganda the Soviet leaders are creating on behalf of the so-called "Stockholm petition.") The Soviet leaders would probably be ready to actually eschew the use of the few bombs available to them in order not to invite retaliation. However, unless American strategic plans are changed by then (and this change made practical by the re-creation of a truly powerful land force in Western Europe), the hand of the Soviet leaders may be forced by American atomic attacks on Soviet centers, which are likely to be our first answer to any Soviet armed aggression of the "conventional" kind. Faced with such attacks, the Soviet leaders will not be able to refrain from an attempt to give the Americans a taste of their own medicine, and will stage at least a few hit-and-run atomic attacks on American cities. In the opinion of many Americans, this close but limited danger may not call for an all-out defense effort which would disrupt the pattern of American urban civilization, cause tremendous additional expenditure, and require extreme forms of government planning and limitations of individual freedom. Many Americans feel that rather than sacrifice so much of the "American way of life" they would prefer to take the risk of living in the old way, and would merely try to reduce this risk by local civil defense measures of the type which are now under consideration in many American cities.

* * *

The responsibility for preparing only for the limited kind of atomic attack which the Soviet Union should be able to deliver now, or in the next few years, could be shouldered by an American government firmly resolved to bring about a showdown—by war, if necessary—before the Soviet atomic arsenal reaches alarming proportions. However, our government certainly does not plan such a preventive action, and it is unlikely that *any* American government will go to war with the Soviet Union unless provoked into it by Soviet aggression against the United States or one of her allies. It is, therefore, in the power of the Soviet leaders to delay the showdown until they feel that their own atomic potential can neutralize the American atomic threat, or if this intimidation fails, can deliver a truly paralyzing attack on American production and distribution facilities. Because of this, we cannot afford to limit our defense preparations to the kind of attack we may face now or in the very near future. Rather, we must, without delay, start preparations for meeting an all-out atomic aggression which we may have to face, say, six or eight years from now.

THE IMPORTANCE OF CIVIL DEFENSE PLANNING

W. Stuart Symington

Mr. Symington, former Secretary of the Air Force, is now Chairman of the National Security Resources Board, the government agency in charge of planning for national civil defense.

IN THIS air-atomic age there is now no place for anyone to hide. Recent testimony before the Congress shows that our defenses against atomic attack can be improved, but, regardless of any additional sum we might spend on these defenses, it is certain we cannot adequately protect ourselves against at least the partial success of a sudden intensive surprise atomic attack.

That attack can be blunted, but cannot be stopped; and its destructive effect will be in direct proportion to our preparation—not only military preparation but also civilian defense preparation.

In this connection a quotation from the first civilian defense report put out by the Pentagon, the so-called "Bull Report," cites what the efficiency of planned civilian defense meant to England in the past war. This report says:

"The advance planning effort of the Home Office can well be credited with averting complete disaster when the enemy struck."

If it was important to plan civilian defense for England's security in 1936, think how much more important it is, in this air-atomic age, to plan now such defense for the United States.

THE MILITARY STRENGTH OF RUSSIA

Nearly five months ago in a talk in Texas, I presented the following six points as to the military strength of Russia. These points contain the best thinking of our own intelligence agencies and those of our allies. They were that:

1. Russia now has a ground army greater in numbers than the combined armies of the United States and its allies.

2. Russia now has an air force whose strength in nearly all categories is the largest in the world and growing relatively larger month by month.

3. Russia now has the world's largest submarine fleet and an intensive submarine development and construction program.

4. Behind the Iron Curtain there has been an atomic explosion.

5. Behind that Curtain is the air equipment capable of delivering a surprise atomic attack against any part of the United States.

6. We have no adequate defense against such an attack.

For the first time in the history of this country, a foreign government has the capacity to attack all our home soil—has the weapons and the means to deliver those weapons; and as its stockpile of atomic bombs grows, as its planes and submarines become improved in quality and relatively greater than ours in quantity, that danger can only grow, week by week and month by month.

This is no theoretical matter to us, and as the military strength of Russia increases, it is certainly not theoretical to our children, especially since the unusual great advantage of a surprise attack like Pearl Harbor has been increased many times as a result of the development of the atomic bomb.

Stalin himself has often asserted, at least once since V-J Day, that the countries of capitalism must be destroyed. In every issue of communist dogma, under the title "Problems of Leninism," published over the signature of Stalin, appears this basic communist tenet:

"We are living not merely in a State, but in a system of States; and it is inconceivable that the Soviet Republic should continue for a long period side by side with imperialistic states. Ultimately one or the other must conquer. Meanwhile, a number of terrible clashes between the Soviet Republic and the bourgeois states will be inevitable. . . ."

As a people we should not only recognize these truths, but should act upon them. With calm but efficient determination, we must plan our resistance in case of attack.

When the late Russell Hopley, able Omaha businessman, submitted his famous report on civil defense[1] to Secretary Forrestal, he said that civilian defense was the "missing link" of our military armor. I think there is another—the second being proper integration of the military potential within the over-all civilian economy, through adequate long-range industrial mobilization planning.

As presented by Mr. Hopley, however, there is no question of the primary importance of civil defense planning, for at least four reasons:

1. The fire power of modern weapons equipped with atomic bombs changes all previous concepts of offensive and defensive warfare;

2. Instead of years to mobilize for victory, as in the past, there may not be hours;

3. For the first time in the history of the United States, there is now an enemy capable of attacking our homeland at any time; and

4. As his strength grows, the chances also grow that the original attack might be fatal.

THE CAMPAIGN OF TRUTH

At this point may I comment on one of the most dangerous lines of talk that is being passed around fairly frequently by various so-called experts; namely, that it is wrong to give truth on these matters to the American people because they will become frightened, possibly to the point of mass hysteria.

Text of an address given before the annual convention of the American National Red Cross in Detroit, June 26, 1950.

[1] Summarized in the *Bulletin*, V (April 1949), 111, 126.

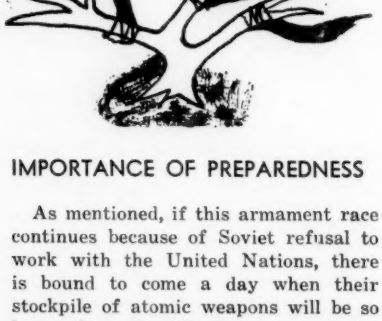
That is not our tradition. That was not true in England. In fact, the chief danger would seem exactly the opposite. Healthy people, apprised of the true details of danger, have a normal tendency to first accept them, and then go about their business. But learning to live with danger does not in any way diminish that danger.

Winston Churchill could bear effective testimony to that latter fact; because for many years he, the realist, tried to waken the British people to the growing menace of nazism.

I believe that on this broad subject of what is needed for our future security there is a growing desire on the part of the American people to get the facts; and it is of course our obligation as public servants to give those facts to them in what our President has so aptly termed a "campaign of truth."

That is the way of democracy—carrying the truth to the people; and that is the only method by which we and our allies can be sure of remaining strong, and therefore secure, and therefore free.

If only these professional "fear boys" would realize that adequate planning, far from being planning *for* war, is planning to *prevent* war, and therefore actually is planning for peace; because one thing is certain—by knowing the aims and ideologies of our only possible enemy, if America and its allies remain strong, we may prevent a future war. If we become weak, however, there will be a future war and the freedom-loving democratic nations are certain to lose it.



IMPORTANCE OF PREPAREDNESS

As mentioned, if this armament race continues because of Soviet refusal to work with the United Nations, there is bound to come a day when their stockpile of atomic weapons will be so large that, if subjected to a surprise attack, our country might receive a blow from which it could not recover; i.e., could not fight back.

"Might" is the important word in that sentence, because efficient civilian defense planning could well make the difference between a serious, and a fatal, disaster.

For example, it is estimated that with only twelve minutes' warning as against no warning, and under efficiently planned civilian defense, the casualties in a city hit by an atomic bomb could be reduced 50 per cent.

Efficient planning of our civilian defense, therefore, might be the deciding factor in our ability to get up off the floor and fight back.

This whole complex question of civilian defense is being worked on, and it is our hope to present an over-all plan this fall. In the meantime some five "memorandums of suggestion" as to organizational structure and procedure have already gone to the governors of all states, in effort to gear any plans of the state and local governments to national civil defense planning.

In that connection there is an interesting quotation from the Hopley report, submitted in late 1948:

"In the event of a future war, which might come to our shores, all of the people, all of the facilities, and all of the skills and energies of the nation must be utilized to the fullest extent. To successfully carry out this program will require the cooperation of every man, woman, and child in this nation. It is on such principles that civil defense must be erected, and it must be with such a requirement that its organization be perfected.

"We hope that the Civil Defense Organization will never need to operate for war, but we dare not gamble on that hope. We who have studied the problem feel a great need for prompt action in establishing such an organization. To be without it leaves us in a most vulnerable position."

There it is, summed up. Everybody must help, because manpower and womanpower will probably be the greatest shortage in any possible future war. Millions of citizens will be needed for civilian defense, thousands of them on full time.

Note that in the past ten years, whereas our country's population has increased from 132 million to about 150 million, in the same period the communist or communist-controlled peoples of the world have increased from 188 million to over 800 million.

RESPONSIBILITY OF COMMUNITIES

The responsibility for creating an efficient, well-prepared Civil Defense Organization rests ultimately on each community. The Federal Government can and will provide guidance, establish standards of uniformity, and propose over-all policy and principle. The state

governments can produce plans and establish state organizations. But an attack by an enemy would be against cities and people, not against state or local governments. And so each community must be prepared, not only to care for its own needs, but also to lend full assistance to other communities.

If a city that presents a desirable target concentration is unprepared, it is of course doubly vulnerable. Let us consider what would happen to an unprepared major city.

Statistics show the heavy concentration of people in the average large city's business area. On a week day, a great many people are in a relatively small area.

If one modern atomic bomb were dropped without warning or preparedness, there would be hundreds of thousands of casualties; and of those, about half would be killed, the balance injured in varying degrees.

Those casualty estimates are from the bomb burst alone; that is, the blast, the radiant heat, and the radiation effects. They do not take into account casualties resulting from ignorance and confusion, inevitable if a city is unprepared.

CIVIL DEFENSE NEEDS

But let's assume that because of efficient civilian defense training there is no panic, and that therefore aid and understanding can promptly reach the disaster area. Consider what is needed in terms of medical supplies alone.

Within the first week, those medical supplies necessary would require hundreds of railroad cars. Litters and ambulances would have to be provided, and tens of thousands of hospital beds would have to be found and made available.

Emergency hospitals would have to be set up in schools, auditoriums, and

armories. Many of them would have to operate without light or water. And there would be the question of adequate numbers of doctors and nurses, plus vast amounts of medical supplies. These supplies would include blood and blood derivatives, since many of the casualties would be burned.

The American Medical Association reports that the total annual supply of blood and blood derivatives in this country today is between two and two and one-half million pints. All of that blood is needed and used *now*. Adequate civilian defense preparedness would, of course, require very much greater inventories. One bomb on one large city would require hundreds of thousands of pints a week.

If we assume that such a surprise attack took place on one city, we must also assume that at or about the same time, other metropolitan areas would suffer similar attacks. Obviously the entire country's supply of blood could not be diverted to one city.

How can this gloomy picture be made lighter? There is a way. Let us assume the city in question and the rest of the nation had a Civil Defense Organization ready for action. It is then probable this city could have some warning of the impending attack. Civilian air raid spotters would supplement the network of electronic warning devices. Fire, police, rescue, welfare, engineering, and other services would carry out their plans.

Because of such preparation the number of casualties, both killed and injured, could be reduced by at least 50 per cent; and again, because it is so very important, that might be the crucial difference between a serious and a fatal attack; in other words, between saving our country, and losing it.

Before the echoes of the blast had died away, civil defense teams of every kind would be on the way, rushing into the area from all nearby communities. Blood plasma and medical supplies would be flowing toward the city from regional stockpiles before the mushroom cloud had broken up. Evacuation centers would swing into action. Every suitable school building in the area would become available as a hospital, with its own power and its own water resources. Emergency transportation plans would swing into effect. The wounded would find much of the care they needed. Countless lives would be saved. In other words, the civilians would be organized.

Through such preparedness we have the best chance of passing on to our children and our children's children the blessings of our own heritage—national security and individual freedom.

THE GOVERNMENT'S ROLE IN CIVIL DEFENSE

The following statements are contained in two addresses given recently by Paul J. Larsen, Director of the Civil Defense Office, National Security Resources Board, at the Uptown Club, New York City, and before a Conference of West Coast Mayors, San Francisco. Before his appointment as Civilian Mobilization Director, Mr. Larsen was Director of the Sandia Special Weapons Base Laboratory at Albuquerque, New Mexico.

CIVIL defense may be defined briefly as the defense of the home front by civilians and civil authority in time of war. It is largely, but not wholly, passive defense. It consists of measures (1) for assisting the military forces in averting an enemy attack, (2) for minimizing the effects of such enemy attacks as may be successful, and (3) for alleviating, controlling, and repairing the damages created by enemy attack. Thus, it seeks to provide maximum civilian support of the war effort.

Brief definitions such as the foregoing are, however, subject to misinterpretation. For better understanding of the term "civil defense," it is essential to examine in more detail the measures to be employed by civilians and civilian authority in their defense of the home front. By so doing, a better appreciation can be had of the importance of civil defense in the total mobilization picture.

For planning purposes, we have divided the necessary civil defense measures into four groups:

1. Measures to avert an enemy attack, such as camouflage, blackouts, aircraft observer systems, and similar quasi-military activities in which civilians may be called upon to assist;

2. Advance measures for minimizing the effects of an enemy attack, including such measures as civil air raid warning, the dispersion or relocation of facilities, and the prior evacuation of children and personnel not essential to the war effort;

3. Measures to alleviate, control, and repair the damages resulting from enemy attack, ranging from medical health services, decontamination, and fire fighting to the removal of debris and salvage; and

4. In connection with the foregoing measures, a group of over-all measures such as research and development, legislation, organization, training, policy guidance, military support, and civil defense requirements.

RELATIONSHIP OF CIVIL DEFENSE TO MOBILIZATION PLANNING

Under the National Security Act of 1947, the National Security Resources Board is responsible for advising the President on the coordination of military, industrial, and civilian mobilization. Civil defense planning was expressly made a responsibility of the Board by Presidential directive on March 3, 1949.

There is a close relationship between planning for civil defense and planning for other forms of mobilization. The protection of our citizens, our homes, and our cities against enemy attack and against the effects of enemy attack is the very essence of national defense and, therefore, plans for the mobilization of our resources must include planning for civil defense as well as for more traditional military needs.

Let me give one example of how civil defense fits into our other mobilization planning work. Before realistic mobilization planning can be accomplished it is necessary to make at least a rough inventory of the nation's resources available in wartime and to compare this inventory with the anticipated needs. The responsibility for this operation is placed on the NSRB by the National Security Act. The needs of any civil defense programs must, of course, be determined in establishing any such balance-sheet.

THE MAGNITUDE OF OUR CIVIL DEFENSE EFFORT

One hundred per cent security obviously is not possible. Nor is an attempt to achieve absolute security desirable under present conditions, unless we are willing to become a garrison state. If too much of our national effort is expended for military and civil defense purposes, the very liberties we are trying to make secure will themselves be endangered. Take, for example, the question of the security of urban populations from the atom bomb: from the security point of view alone, the solution would appear to be compulsory dispersion. But what would this mean to our economy and to our democracy?

The dollars and cents cost of decentralizing the some two hundred cities in the United States having populations of more than fifty thousand would probably be in the neighborhood of $300,000,000,000. The social and political costs of such complete decentralization might put an end to democracy as we know it. To accomplish such a program of compulsory dispersion we would have to be willing to become a garrison state.

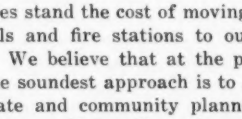
The determination of the civil defense measures which can and should be taken now necessarily involves reconciling the needs of civil defense with other national objectives and programs which are also fundamental to our national security. It would be imprudent if the Federal Government were to fail to take those steps necessary to a sound civil defense program; but it would be just as imprudent if we were to allot too great a part of our security budget to civil defense measures at the expense of our first line of defense, the armed forces.

At the present time, the need is for intelligent basic planning upon which operating civil defense programs at the federal, state, and local levels can be built. Premature action, based on ill-considered plans, could prejudice the effectiveness of our civil defense in time of enemy attack.

What would we do if bombs should fall tomorrow? Would we be ready?

To be frank, the answer is that we would not be ready tomorrow—not as ready as we will be a year from now, but more nearly ready than a year ago. Should one of our cities be attacked, it would have to rely primarily on existing services: in the first instance, on its own fire-fighting and police forces and on its own medical resources, then on available military forces. Existing federal agencies would offer technical assistance: the Public Health Service, which has played an important part in developing plans for the health and medical aspects of civil defense, could assist local authorities in such matters as organizing first-aid stations and emergency hospitals, treating radiation burns and sickness, and administering blood collection and transfusion programs; the Bureau of Animal Industry could inspect the available meat supply and take action against animal disease; and the Children's Bureau could assist in handling the problems of homeless children. The American Red Cross would, of course, play an important role in emergency mass care.

Being ready is necessarily a relative matter. Frankly, I wonder whether we would want to be in a state of absolute readiness. Do we want our women and children evacuated from our cities? Can our cities stand the cost of moving their hospitals and fire stations to outlying areas? We believe that at the present time the soundest approach is to stimulate state and community planning of how they would handle such problems as evacuation and of how one community could call on another for aid. Resource studies should be made so that the needs for fire-fighting equipment, hospitals, and reserve supplies of water can be determined. These are among the steps we have already recommended to the states to increase their preparedness.



RESPONSIBILITY FOR CIVIL DEFENSE PLANNING

Civil defense is a national task which must be shared by all levels of government—federal, state, and local. The Federal Government has the important obligation of developing and furnishing to the states and local governments the information, advice, and guidance which they need to develop sound plans for their own communities.

The detailed planning for specific communities must be done by local governments. Civil defense must be based on self-help. Effective community action in time of disaster requires the development, in peacetime, of a sense of community responsibility for self-preservation. When disaster stricks, immediate action may prevent complete calamity.

The main effort, therefore, must come from the individual citizen and the community group, with needed help coming from county, state, and federal agencies as time allows. For this reason among others, the preparation of detailed disaster plans, geared to the state's plan, should be the primary responsibility of the community. The Federal Government, of course, has the important responsibility not only of furnishing guidance to states and communities for the development of their plans, but also of being ready to render aid to states and communities in time of actual or impending enemy attack.

On the question of civilian versus military control, let me say that civil defense is a responsibility which must be assumed by civilian government, not by the armed forces. In time of war the armed forces must concentrate on their primary mission of repelling attack and carrying war to the enemy. Certain quasi-military measures included in our broad definition of civil defense are properly the responsibility of the military, even though they may involve civilian participation—measures such as blackouts, radio-beam controls, and aircraft-observer systems. But fire fighting, evacuation, care of casualties, and the like, are essentially civilian in nature. They will require a great amount of local manpower. Since civilians must perform such functions, they should be responsible, at all levels of government, for planning them.

The program which the National Security Resources Board has undertaken has had the aim of formulating a comprehensive civil defense plan from the standpoint of the Federal Government, the implementation of which would be responsibility of the states and local community organizations. Our method of planning has differed from that of other nations, because of our governmental structure, and of our belief that civil defense operations must be carried out in the framework of our democratic system of government.

Even after implementation of the plan, it is our belief that the responsibility of the Federal Government in civil defense activities will not require the existence of a large federal organization. The federal agency for civil defense will have, prior to mobilization, the following main responsibilities:

1. To formulate a federal plan which would have to be accepted by states and local communities;

2. To assist states and local communities in training of volunteer workers;

3. To establish national schools for

training of key state and community civil defense personnel;

4. To evaluate requirements of equipment and resources for civil defense, and to determine which of these should be obligations of the Federal Government and which should be supplied by state and local communities;

5. To evaluate weapons effects in order to determine sound dispersion and evacuation policies of government agencies and of other vital installations;

6. To maintain such reserve stores or critical materials as will be required in event of disaster, and to control and distribute these to communities requiring them in the event of disaster; and

7. To maintain close contact with the public and liaison with public groups through dissemination of information and education on dangers for which the people should prepare, without introducing hysteria or fear, which would damage public morale, decrease civilian participation in the civil defense program, and affect the main function of civilian population in wartime—to maintain full activity on behalf of the war effort.

In our estimation, the national plan can be implemented, for the present, by the states and local communities, without necessity for federal civil defense legislation beyond that already existing in the National Security Act of 1947. Additional legislation will be requested in due time, so that the Federal Government can implement its planning, training, and operation program, establish supply reserves for emergency use, and create an operating federal organization.

STEPS ALREADY TAKEN BY THE FEDERAL GOVERNMENT

Here are a few of the positive steps taken at the federal level to provide proper material and guidance to the states and cities and thus aid in their planning of an integrated civil defense program:

1. Five detailed advisory bulletins have been sent to the Governors, the first one on October 5, 1949.

2. In the radiological field of defense against atomic warfare, a number of civil defense training courses have been completed under the direction of the National Security Resources Board in cooperation with the Atomic Energy Commission. These training courses were given priority because of (*a*) the immediate need for informed persons to serve as advisers to state civil defense authorities; and (*b*) the long period of time required to recruit and train instructors, and an adequate number of radiation monitors.

Suggestions will soon be formulated and submitted to the states concerning a second area of training in the medical aspects of civil defense, which will instruct physicians, dentists, and nurses in the treatment of atomic bomb casualties. Further training could be carried out under the direction of the state civil defense agencies through state health departments, medical associations, hospital staffs, and medical schools.

It is too early to start more advanced courses of radiological monitoring, and it is recommended that states and cities do not procure radiological monitoring instruments until certain improvements recommended by the Civilian Mobilization Office, have been effected.

3. President Truman has addressed a specific message to the U.S. Conference of Mayors which met at the Waldorf Astoria Hotel in New York on May 11 of this year, on the subject of civil defense.

4. Three major cities, Washington, D.C., Seattle, and Chicago are now conducting studies and practical tests as an experimental group to help in the preparation of an interim civil defense plan.

The purpose of this plan is to provide municipal authorities in our metropolitan areas with a practical, interim program of civil defense, using only the resources they now have at hand. This interim plan is being worked out because it will take many months to develop a final full-scale civil defense program for the cities throughout the country.

The National Security Resources Board initiated this project, in cooperation with the three cities mentioned above, on the basis of a joint staff study, to determine the probable effects of an atomic attack on the personnel and resources now available in a metropolitan area for emergency civil defense.

The method is to assume that an air raid with atomic weapons has taken place and that a certain number of atomic bombs have been dropped at a certain designated "ground zero." Sufficient data has been made available to the states and cities on the effects of atomic explosions to enable the local civil defense authorities to determine the probable consequences of the assumed attack.

The municipal specialists will then determine the civil defense steps they would take under the assumed conditions, utilizing both the municipal and the private facilities which will be left available after the attack. They will formulate practical suggestions in all fields, including police, fire, essential services, housing, feeding, medical care, demolition, removal of debris, traffic control, public information, public health, administration and mutual aid—to mention only the more obvious.

Arrangements have been made by the NSRB with Governor Langlie of the State of Washington, Mayor Devin of Seattle, Governor Stevenson of Illinois, and Mayor Kennelly of Chicago for studies of this kind, similar to the agreement concluded with authorities in Washington, D. C.

The results obtained by these three studies will provide a wealth of practical data to serve as a guide for studies by other cities.

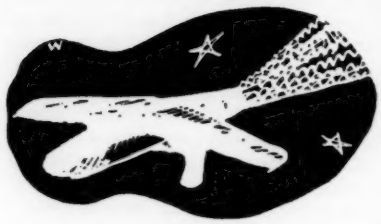
This interim program, which will be sent out to the states and cities, can be used by them to conduct similar studies in conjunction with their civil defense planning programs.

5. The basic National Civil Defense Plan will be ready by mid-September of this year. In September, the Governors, and the cities through the Governors' offices, will receive both the interim plan and a long-term program for their guidance.

THE EFFECTS OF ATOMIC WEAPONS

Joseph O. Hirschfelder

Dr. Hirschfelder, Professor of Chemistry at the University of Wisconsin, was Chairman of the Board of Editors of "The Effects of Atomic Weapons," which was issued on August 8 by the Atomic Energy Commission. This handbook, comparable in importance to the Smyth Report, supplies the scientific and technical background for civil defense planners. The present article summarizes much of the material in the handbook.



WE MUST learn to face the dangers of an atomic war just as our ancestors learned to face the dangers of cholera and smallpox epidemics. In place of the epidemics, we now have a man-made scourge with which to contend. There are many preliminary steps which should be taken in preparing to meet this new danger. Most of the civilian defense problems are the same, regardless of whether protection is sought from conventional bomb raids or from atomic bombing. The number of casualties would be very greatly reduced if an air raid warning were sounded and the majority of the people were in shelters or cellars at the time of the explosion. First and foremost, it is necessary to educate the public so that they can cooperate in avoiding panic. People need to understand the nature of nuclear radiation and to learn the conditions under which they are in danger from it. The fact that nuclear radiation can be neither seen nor felt makes it particularly insidious and subject to misconceptions.

The atomic bomb is a flexible weapon whose exact manifestations depend a great deal on the manner of delivery. It is important to make a sharp distinction between the high air bursts (such as at Hiroshima and Nagasaki) and the low ground or underwater explosions. In the high air bursts there is no lingering contamination and the danger from radiation is confined to the first minute. After a low ground or underwater explosion, contamination might remain a serious problem for months if not years. Obviously entirely different preparations must be made to cope with the two different types of catastrophes.

Most of the discussion here will be limited to bombs of the Hiroshima or Nagasaki types which release an energy of 20,000 tons of TNT. Hydrogen bombs would produce the same sorts of casualties and damage out to distances which scale roughly as the one-third power of the energy released. That is, a bomb releasing 160,000 tons TNT would produce casualties and damage to approximately twice the distance from the center of the explosion as from our 20,000 ton explosion—a terrific explosion of 1,300,000 tons would produce damage and casualties up to four times the distance.

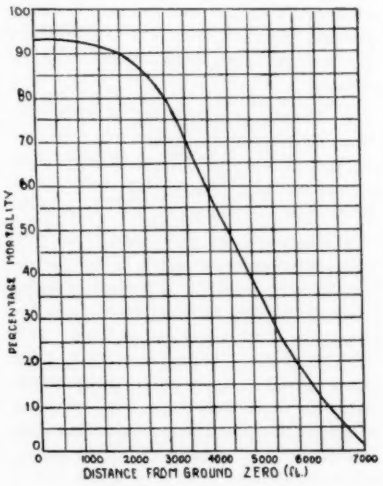


FIG. 1.—*Percentage mortality as function of distance from ground zero.*

All of the quantitative data, including tables and figures, presented here and most of the basic facts have been taken from the Atomic Energy Commission treatise, *The Effects of Atomic Weapons* (Government Printing Office, 1950), $1.25. The interpretation of the facts represent the viewpoint of the author and are in no sense supposed to represent any official policy or opinion.

HIGH AIR BURST

The greatest attention should be given to a defense against high air bursts since they would cause the greatest general damage and probably produce the largest number of casualties in a city. The accounts of the destruction of Hiroshima and Nagasaki present in graphical form what might be expected in an American city.

Table 1 shows the physical damage to be expected. All buildings within a radius of a half mile would be demolished; between a half mile and a mile and a quarter they would be rendered unusable; and between one and a quarter and one and three quarters miles the damage would be severe to moderate. American buildings are characterized by brick and stone facings which would be reduced to rubble. "Earthquake proofing" according to certain West Coast building laws is a desirable safeguard. This means increasing the cross-bracing and the ability of the structure to withstand wind loads. There is surprisingly little earth movement as a result of a high air burst so that underground utilities would not be as badly damaged as after a large normal bombing raid where small high explosive bombs actually hit the ground before exploding. However, emergency cut-off valves would be desirable on both water and gas mains to counter possible damage to power houses, waterworks, and other structures to which utilities are connected.

Distance is the best protection from the atomic bomb. Figure 1 shows that 85 per cent of the people at a distance of one-half mile would be killed, 35 per cent at one mile, and only 2 per cent at a mile and a half. There is little hope of survival for people within a half mile inasmuch as shelters would have to be exceedingly strong and prob-

Table 1. AIR BLAST DAMAGE: Japanese Experience

WIND VELOCITY (mph)	DURATION (sec)	OVER-PRESSURE (psi)	MILES	FEET	DAMAGE
					Limit of light damage at 8 miles.
80	1.25	1.5		12,000	← Light damage to window frames and doors, moderate plaster damage, complete window damage.
			2.25		
60	1.23	1.7		11,000	← Flash charring of telegraph poles. Roof and wall covering on steel frame building damaged.
			2.0		← Partial damage to structures in area.
70	1.20	2.0		10,000	← Blast damage to majority of homes. Severe fire damage expected. Flash ignition of dry combustible materials.
			1.75		
80	1.18	2.4		9000	← Heavy plaster damage.
					← Moderate damage to area.
100	1.12	2.9		8000	← Severe damage to homes, heavy damage to window frames and doors, foliage scorched by radiant heat.
			1.50		
125	1.06	3.6		7000	
			1.25		← Structural damage to multistory brick buildings. ← Roof tiles bubbled (melted by heat).
160	0.98	5.2		6000	← Severe damage to entire area. ← Severe structural damage to steel frame building. 9" brick walls moderately cracked.
					← Electrical installations and trolley cars destroyed.
			1.0		← Multistory brick building completely destroyed.
200	0.90	7.4		5000	← 12" brick walls severely cracked.
					← Steel frame building destroyed (mass distortion of frame). ← Light concrete buildings collapsed.
270	0.77	10	0.75	4000	← Reinforced concrete smoke stack with 8" walls overturned.
					← 18" brick walls completely destroyed.
380	0.62	18		3000	
			0.50		← Virtually complete destruction of all buildings, other than reinforced concrete aseismic design.
550	0.45	24		2000	← Limit of severe structural damage to earthquake-resistant reinforced concrete buildings. ← Reinforced concrete building collapsed, 10" walls, 6" floor.
			0.25		← Mass distortion of heavy steel frame buildings. Loss of roofs and panels.
800	0.37	36		1000	← Decks of steel plate girder bridge shift laterally.
				0	Air Burst of an Atomic Bomb.

Prepared by Curtis Lamson and Sherwood Smith

ably deeply buried in order to offer adequate protection for such victims. Most of the civil defense measures should therefore be directed toward saving those people who are between one-half mile and a mile and a half at the time of the explosion.

The number and kind of casualties will depend a great deal on whether the people have been properly warned so that they are in shelters or whether they are caught by surprise. Considerable attention should be given to developing a satisfactory system for insuring the transmission of warning signals both before and after the explosion. At Hiroshima and Nagasaki a large proportion of the casualties occurred among people who were out of doors or in exposed positions. At Hiroshima and Nagasaki approximately 100,000 casualties were produced by high air bursts. These casualties were of three sorts: ordinary (first, second, and third degree) skin burns, trauma from flying debris, and radiation sickness from gamma rays. Most of the casualties were from skin burns, and only 5 to 15 per cent from nuclear radiation. The skin burns arise from both primary and secondary causes. The primary burns are due to direct exposure to the intense light given off by the bomb; the secondary burns are due to victims being trapped in buildings that have caught fire, etc. Even the simplest sort of shelters would offer protection from skin burns and flying debris.

The care and treatment of normal skin-burn casualties is extremely difficult, and only the most rudimentary first aid could be given to a large number of victims. A large number of people should be trained in the medical treatment of skin burns, as a sufficient number of doctors and nurses could not be provided for this purpose.

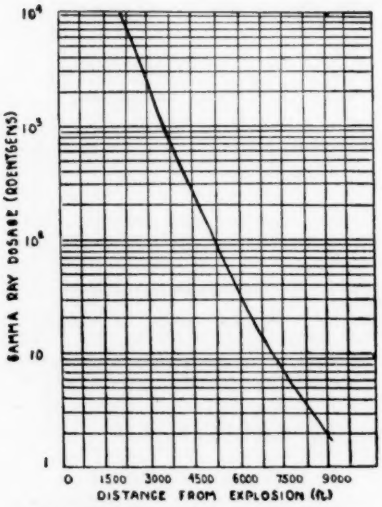


FIG. 2.—*Total dosage of initial gamma radiation as function of distance from explosion.*

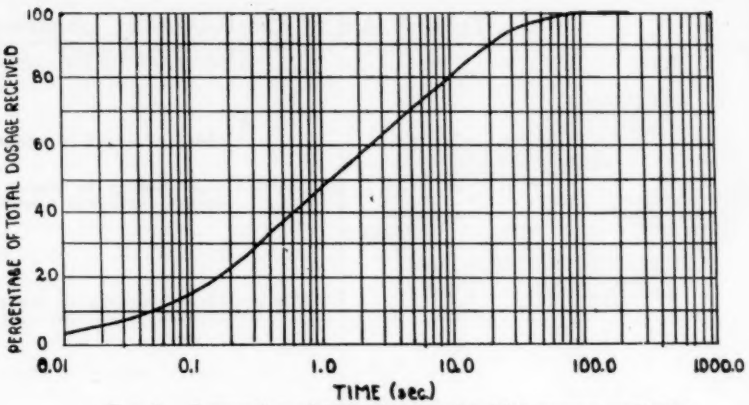


FIG. 3.—*Proportion of total dosage of initial gamma radiation received as function of time after explosion.*

A fraction of a second after the bomb has exploded, a ball of fire shoots out to a radius of 150 yards and gives off light of the same spectral characteristics as the sun. To a person within a few miles, the ball of fire would seem to occupy a fraction of the sky hundreds of times larger than the area occupied by the sun, and the intensity of the light from the ball of fire is correspondingly greater. On a clear day, the light from the ball of fire will produce incendiary action up to a mile and a half and produce skin burns in exposed personnel up to a distance of two miles. A careful study indicates that, at great distances, it is the infra-red radiation occurring for a period of three to five seconds (rather than the ultraviolet light which occurs for only a small fraction of a second) which is responsible for the burning. Because of the comparatively long duration of the thermal radiation, exposed personnel can greatly reduce their exposure by ducking behind an obstacle or dropping prone. Ducking behind an obstacle would also considerably reduce the exposure to gamma rays and place the person in a more sheltered position to withstand the flying debris which will shower the area a few seconds later when the blast wave passes. It takes the blast wave one second to reach one-half mile, three seconds to reach one mile, and seven seconds to reach two miles.

Most of the fires and some of the skin burns result from secondary causes, such as the overturning of stoves, explosions of gas tanks, etc. Under some meteorological and topographical conditions, the whole area beneath the explosion will be converted into a huge fire storm or giant bonfire. At Hiroshima such a fire storm occurred, but not at Nagasaki. Fire storms increase the difficulty of escape from the affected area and thereby increase the number of casualties. The incendiary action of the thermal radiation can only produce serious fires when it impinges on suitable kindling such as window drapes or curtains. Black materials absorb more of the light than white objects and are therefore more likely to ignite.

The only nuclear radiation hazard associated with a high air burst is direct exposure to gamma rays which are emitted during the first ten seconds after the explosion. Most of the neutrons are slowed down and absorbed before they reach the ground. Only at points very close to ground zero would the neutron discharge be lethal. The lethal radius as far as direct exposure to gamma rays is concerned is around 4,000 feet; and lethal radius for a person protected by one foot of concrete is still around 3,000 feet. The gamma rays are similar to unusually hard X-rays of 4.5 million electron volts energy, and they can be neither seen nor felt. However, they darken photographic films and are easy to detect with Geiger counters, electrometers, or other suitable instruments. These instruments are extremely sensitive and can respond to radiation doses which are one/one-billionth of the amount which would be physiologically dangerous. Radiation dosage is measured in roentgen units designated by "r." For peacetime operations it is customary to limit exposure of personnel to a maximum of 0.3 r per week, as it is believed that the body can repair the amount of tissue damage which this rate of exposure would produce, and repeated doses of this

size would not produce harmful effects. However, in time of disaster it may become necessary for a person to accept a single non-repeated dose of 50 or 100 r. A single dose of 50 r, if not repeated, would probably not produce harmful effects. A larger dose might produce significant pathological changes. The median lethal dose is approximately 400 r, and it is expected that few casualties would occur at 200 r and very few survivors would be left after 600 r. Figure 2 shows the dosage as a function of distance from a high air burst. Figure 3 shows the percentage of gamma rays emitted as a function of time. Fifty per cent of the gamma rays are emitted in the first second, and 90 per cent within the first ten seconds. Figure 4 shows the protection afforded by concrete. The effectiveness of other materials for shielding purposes against gamma rays is determined mainly by their density; that is, a layer of lead, concrete, dirt, water, or iron weighing 100 pounds per square foot would have essentially the same shielding power. Table 2 shows the attenuations of different thicknesses of various materials.

A person who has been exposed to more than 100 r may develop radiation sickness. If the exposure has been severe (more than 300 r) there will be initial symptoms such as nausea and malaise after the first hour and lasting for the first day or two. Otherwise there may be a latent period of one to three weeks before the sickness develops. The principal effect of the radiation is to destroy, at least temporarily, the ability of the bone marrow to produce new blood. As a result, victims of radiation sickness develop anemia and

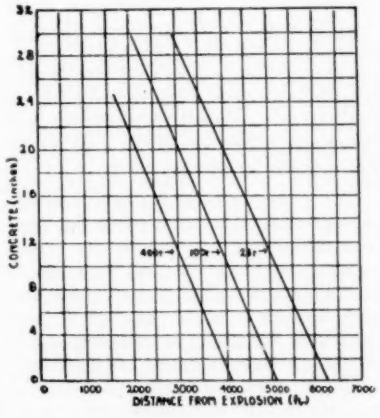


FIG. 4.—*Thicknesses of concrete required as function of distance from explosion to reduce initial gamma radiation to various amounts.*

TABLE 2-A

SHIELDING REQUIRED VERSUS DISTANCE FOR HIGH AIR BURST (4.5 MEV GAMMA RAYS)

Distance in feet at which radiation is mean lethal dose	Shielded radiation intensity divided by unshielded radiation intensity	Thickness of Shielding Material in Inches			
		Water	Concrete	Lead	Iron
4300	1.0	0	0	0	0
3200	.2	30	11	3.8	1.6
2700	.1	40	15	5.2	2.3
1700	.02	70	25	8.3	3.9
1100	.01	80	30	9.5	4.6

TABLE 2-B

SHIELDING FOR PROTECTION VERSUS DELAYED RADIATION OR EXTERNAL CONTAMINATION, AS FROM A GROUND OR UNDERWATER BURST, (0.7 MEV GAMMA RAYS)

Shielded radiation intensity divided by unshielded radiation intensity	Thickness of Shielding Material in Inches			
	Water	Concrete	Iron	Lead
1.0	0	0	0	0
.2	12	5.1	1.8	0.7
.1	16	6.8	2.4	1.0
.02	25	11.0	3.9	1.7
.01	29	13.0	4.5	2.0

have little resistance to infections. After one to three weeks they develop epilation, loss of appetite, sore throat, internal bleeding, pallor, and diarrhea. The later and less severe these symptoms are, the greater is the chance of survival. The patients should be given complete rest and avoid fatigue. Whole blood transfusions are useful in combatting the anemia, and antibiotics are helpful in controlling the secondary infections. Depending on the severity of the dose, the person may start to recover gradually after the first one to three months. A person who has recovered from such a sickness has a somewhat greater chance of developing cancer than he would have otherwise. A few of the people at close distances at Hiroshima and Nagasaki who managed to survive very heavy exposure to radiation, shock, and burns, have developed cataracts in their eyes. Temporary sterility results from a severe exposure to radiation, but most of the Japanese victims recovered their normal sexual potency at the same time as their general health was restored. Experimental data are not yet available for predicting accurately the results of radiation in the human population after several generations.

From the civilian defense standpoint it is important to note that those victims who have suffered primarily from radiation may not become sick and may even perform physical work for a week or so. A person who becomes nauseated right after the explosion should not, for that reason, be supposed to have suffered a large exposure to radiation—a great many other people who have not been exposed to radiation will also be nauseated from the shock and excitement.

Critical distances at which different types of damage and casualties occur are shown as a function of bomb energy in Figure 5. Even the simplest sort of bomb shelter offers great protection from the two primary hazards—skin

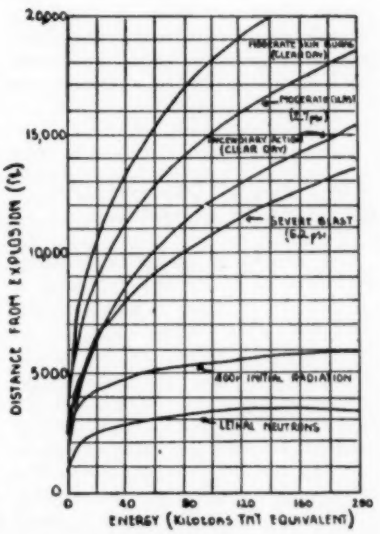


FIG. 5.—*Distances from explosion at which various effects are produced as function of bomb energy.*

burns and flying debris. A small corner of a cellar reinforced so it would not cave in might very well suffice. If special shelters are built they should be made of reinforced concrete or corrugated sheet iron so as to be able to withstand a static load of the order of 500 pounds per square foot, and have a total thickness of roof and sides protected by two feet of concrete or three feet of dirt. The population should be instructed to wait two minutes. If there is reason for supposing that a second atomic bomb may be exploded within a short time in the same locale, the people should remain in their shelters. Then, because of the fires and fire storms, get out of the area soon and in as orderly a manner as possible. Avoid panic at all cost.

The population can return to the affected area as soon as the fires are under control. There is no danger from residual radiation after a high air burst.

After the first minute there is so little radioactive contamination that there is no danger from external exposure. However, in some regions within a few miles of the explosion there may be a "fall-out" or disposition of a small amount of radioactive dust which will be readily detectable by Geiger counters and other instruments sensitive to gamma rays. In these regions it would seem like good common sense to be somewhat careful for a few days, until properly monitored and found to be safe. Water which has passed through a filtration or ion-exchange purification plant or water which has diffused through soil to a moderately deep well should be perfectly safe. Foodstuffs which are kept covered, well-wrapped, or canned are also safe.

LOW GROUND OR SHALLOW UNDERWATER EXPLOSIONS

Low ground or shallow underwater explosions in a city would produce a catastrophe of quite a different sort from the high air bursts. The area in the immediate vicinity would be utterly destroyed with the building materials pulverized or melted. But the total area over which the buildings are rendered unusable is considerably smaller than from a high air burst. The number of casualties from fires, flying debris, and initial gamma rays would also be considerably less. However, a low ground burst or a shallow underwater explosion might seriously reduce the economic effectiveness of a large area by spreading radioactive contamination. The number of casualties resulting from the radioactive contamination would depend a great deal on the civilian defense—whether the people have been properly warned so that they are in their shelters or cellars at the time of disaster and whether they are warned to remain in these shelters for a period of two to four hours.

A low ground or underwater explosion picks up large quantities of dirt or water which become contaminated with fission products. This dirt or water rains down over a large area. Wherever this dirt or water has fallen, the intensity of the radioactivity is dangerous or lethal. The principal danger is from gamma rays of approximately 0.7 million electron volts energy. These gamma rays are almost as penetrating as the 4.5 Mev initial gamma rays from the high air burst[1] and require a thickness of many feet of concrete to render adequate protection. However, the intensity of the gamma rays from the fission products decreases approximately inversely with the time[2] so that after one hour the intensity is only half as great as after one-half hour, etc. After a period of between two and four hours, it should be relatively safe for the people to try to escape from the affected area. As soon as possible after escaping they should remove any clothing which might have become contaminated with radioactive dirt or water and scrub themselves with soap and water. The radioactive fission products are made up of thirty-seven different chemical elements, each more or less radioactive and each occurring in all sorts of chemical compounds. On account of the chemical complexity of the radioactive contamination it is difficult to completely remove the contamination. Special methods for decontamination are effective under special conditions, but soap and water and old-fashioned scrubbing is a satisfactory universal decontaminating process.

Trained radiation monitors become the most important individuals after a low ground or underwater explosion. At first they may assess the intensity and location of the radioactive contamination by penetrating as far as possible into the affected area and by making passes in low flying airplanes or heliocopters over the affected areas. As a result of their initial survey, civilian defense headquarters can signal to people in different locations when it becomes safe for them to escape from the affected area. Trained monitors should accompany rescue missions and direct the evacuation operations. Later, they can assist in laying plans for the early resumption on a limited scale (within a few days) of strategic port facilities, transportation, and industries. In so doing they would bear in mind the facts that the radiation dose is the product of the intensity of the radiation times the time of exposure, and the radiation intensity decays approximately inversely with the time after the explosion. That is, it would be possible for men to work two hours a day at the end of a week in a location in which it would not be safe to work eight hours a day until the end of the first month. The monitors would also ascertain the necessity of decontamination operations and plan for the rehabilitation of the area.

During the first two weeks to a month, the primary dangers in the affected area are from the external exposure to gamma and beta rays. This danger can be measured easily with Geiger counters, films, etc. But after the first month or so the primary danger comes from the ingestion of radioactive dirt by breathing or eating and physical contamination of wounds or abrasions of the skin. The dangers from such internal contamination are very difficult to assess and a great deal of research must be conducted to establish suitable criteria of safety. The problem of moving a population back into an affected area is further complicated by the fact that different individuals, for example a sedentary worker, a ditch digger, and a child, swallow different amounts of dirt! It is not unlikely that an area could be rendered unsafe for normal residence occupation for a year after an attack, although the full industrial utilization of the area might be accomplished much sooner.

The contamination of water supplies or reservoirs should not cause any serious difficulties as most of the radioactivity would be removed by a filtration or ion-exchange plant or in passage through a soil bed to a moderately deep well. Chlorinating or boiling water does not remove radiation. In any large body of water or harbor the radioactivity would diffuse so that in a short time (a few days at most) the water would become harmless. In any contaminated area food should be kept

(Continued on page 285)

[1] Roughly it requires one-half the thickness of shielding material to reduce by a given factor the intensity of 0.7 million electron volt rays as for 4.5 Mev gamma rays.

[2] More accurately, the gamma ray intensity varies as $t^{-1.2}$.

THE STRATEGY OF CIVIL DEFENSE

Ralph E. Lapp

Dr. Lapp, author of "Must We Hide?" has recently left the Office of Naval Research, where he was Acting Head of the Nuclear Physics Branch, to organize a writing and lecturing service. Previously Dr. Lapp was scientific advisor to the War Department General Staff and during the war was Assistant Director of the Metallurgical Laboratory (Manhattan Project) in Chicago. An earlier article, "Atomic Bomb Explosion—Effects on an American City," appeared in the Bulletin in February, 1948.

THE rapid cascade of recent events looms as the overture to war. As a result, civil defense has become a matter of life-and-death seriousness. What is to be our strategy in the defense of our sprawling cities with their congested masses of population? How do we face the peril of an atomic war?

Before we launch into a discussion of what we can do in the area of civil defense, we should consider what has been done and what is being done. Just where do we stand on the vital issue of civil defense? The past can be summarized very briefly by saying that we have toyed with the problem by writing a few reports on civil defense administration. Nothing of any substance has been accomplished in the past five years.

A few cities have made preliminary skirmishes with the civil defense nightmare. Washington, D.C., in particular, has publicized its attack upon the problem. At the end of July it was announced that $290,000 might be appropriated for the newly created Office of Civil Defense for the District. Almost simultaneously $15,000,000 was approved for the construction of another government building in the heart of the nation's capital. Thus we proceed, one step forward and ten steps backward.

We will begin to be serious about the protection of our cities when we stop cramming more buildings into them. The city is the heart of our vulnerability to atomic attack. Unless we reduce the concentration of buildings and people in them, we will never know true civil defense.

Today there is great interest in civil defense, but there are no civil defense measures in effect which will be useful in time of attack. The cities look to the Federal Government to supply the plans for home defense. In June, a group of civic leaders on the West Coast ganged up on the National Security Resources Board and demanded that the Board produce its civil defense plan. Under this pressure, Dr. Paul J. Larsen, Director of Civilian Mobilization for the Board, stated:

". . . I want to assure you that the Federal Government is developing a modern, flexible, and practical civil defense program to meet all types of twentieth century warfare. We have little doubt that the final results, implemented by state and municipal authorities and the general public, will be adequate to whatever situation an enemy might impose upon us."

The NSRB plan is due out in September. It is highly probable that this plan will be a new edition of the Hopley report, revised and enlarged and with something for everyone in it. I suspect that it will be a very detailed treatise listing what the police, firemen, mailmen, and doctors should do. By its very bulk it will show that official Washington is hard at work on civil defense. It will satisfy the politicians and the non-critical civic leaders, for there will be a wealth of fairly inexpensive and not too annoying projects which the cities can undertake.

DISPERSAL KEY TO EFFECTIVE ATOMIC DEFENSE

There is, however, no civil defense program, either in fact or in preparation, which can be both pleasant politically and adequate to cope with atomic attack. The only effective atomic defense consists in dispersing our industry and our population. It involves before-the-fact measures, not after-the-fact relief. But dispersion is political dynamite. Can you imagine a Senator voting to move defense industries out of his state or even to transfer them within it?

While dispersion is the only really effective answer to the atomic bomb (and to the hydrogen bomb, as well), it is a defense which requires years to perfect. The acceleration of world events focuses attention upon the more immediate future. Civic leaders want defense now, not in 1960 or 1970.

The city fathers also want a defense which will not be very expensive and will not upset the status quo of community life. Any plan, such as dispersion, which would upset the established pattern of city life, will be largely disregarded.

No magic plan for civil defense exists. Nor will any be found this summer. The hard facts of the situation are that you cannot live in a large city and still be safe from atomic attack. Improved A-bombs and the yet-to-be-developed H-bombs are powerful weapons that can blot out areas ten, twenty-five, or fifty square miles at a single blow. Thus an attack can wipe out a small city and eviscerate even a large city with the employment of a single bomb.

You cannot provide effective defense if you wait for the attack to occur and then rush around after the fact trying to reduce the casualties. Yet this is precisely the philosophy of the few people who have emerged from Washington to advise local authorities on civil defense planning. Great emphasis is placed upon the training of medical men so that they will recognize atomic injuries and know how to treat them. Now we must certainly make provision for such palliative measures, but it is ridiculous to base

Adapted from a speech given at the American Conference on Foreign Affairs, Colgate University, July 8, 1950.

a civil defense plan on such an approach.

Consider, for example, a single atomic attack upon Chicago. Using an atomic bomb an enemy could kill 200,000 and injure 250,000 people. Imagine treating and hospitalizing a quarter of a million people in one day in a single city! The blood plasma requirements alone are tremendous. It would take a year's blood plasma supply for the whole United States to handle this single catastrophe.

ATOMIC BOMB: TRIPLE-THREAT WEAPON

An atomic bomb is a triple-threat weapon for it combines three effects within a single package. When a bomb is exploded, damage is done by the blast effect which knocks down buildings and destroys facilities over a large area. There is not much you can do about the blast effect. You may wish to build stronger buildings, but to make a bomb-proof building is impractical.

The fire hazard accompanying an atomic detonation is extremely serious. Even if you increase the size of your Fire Department to ten times its present size, it will not have much effect on fire damage. To be truly effective, before-the-fact measures must be undertaken. Such projects as green belts or fire lanes through a city will be most effective in confining the myriad fires which break out simultaneously after a bomb explosion.

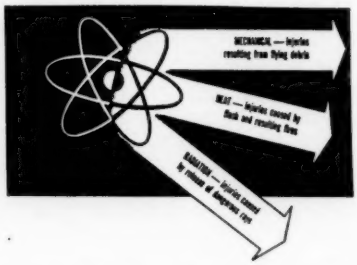
The third hazard from the super-explosives is radioactivity. When a bomb is exploded there is a flash of penetrating radiation which does damage to human beings within one mile from the explosion center. If the bomb is burst in air, then this is the only hazard from such an explosion. If the bomb is burst at the surface or below the surface, as in a harbor, bomb fragments are trapped and remain in the vicinity where they may constitute a radioactive hazard.

Radioactivity has become a kind of national villain. As such, radioactivity has been grossly exaggerated as a hazard, and I personally believe that in an atomic war we would pay little attention to it.

The best way to avoid being injured by an atomic explosion is to be as far away as possible when the bomb is detonated. This self-evident fact should form the real basis for civil defense.

This ideal solution of "not being there when it happens" has two aspects. On a long-time base we can arrange our industry and our population so that they do not concentrate into a few prime target areas. This is true dispersion. It is the only civil defense measure which provides security during atomic attack. On a short-time base we can simulate dispersion by evacuating our cities.

Once war seems inevitable and attack is imminent, evacuation of our large cities must proceed on an orderly and a planned basis. Millions of people must be moved to villages, towns, and hamlets, or to houses by the side of the road. Our metropolitan areas will become temporary ghost towns inhabited only by skeleton crews of essential workers necessary to keeping the city in stand-by condition. The industries which we have been so foolish as to leave in the metropolitan zone will have to be staffed by workers who will live in dispersed suburban communities. Such evacuation is the only means of preventing millions of casualties which would otherwise result if the cities were inhabited.


MECHANICAL — injuries resulting from flying debris
HEAT — injuries caused by flash and resulting fires
RADIATION — injuries caused by release of dangerous rays

Threefold effect of atomic weapons

The drastic relocation of millions of people in the space of a few days calls for the utmost in planning transportation, housing, food supply, and communication. Yet, if we do not plan we may witness a terrible Orson Welles-like exodus from our major cities. Rather than risk the catastrophe of a headlong outgushing of massed humanity from our cities, we should plan for the orderly redistribution of these people to areas which are safe from the threat of attack.

Some may argue that people will stay put in cities and take their chances of being obliterated. This may be true before the first A-bomb is exploded, but I think that the first detonation will induce an exodus from most cities. There is a very great difference between taking chances with ordinary bombs and with an A-bomb. You can always hope that a blockbuster will fall two blocks away. Furthermore, not all the blockbusters are dropped at the same instant, and you can seek shelter. With the case of the A-bomb the attack is virtually instantaneous, and, even if it explodes a mile away, your chances of survival are not good. I think that this difference is enough to convince people that it will be healthier to sleep in a hay stack ten miles from the city limits rather than in a feather bed in the heart of the city.

NEED FOR IMMEDIATE PREPARATION

The rate at which we prepare for civil defense is the subject of much controversy. Some argue that the Soviet Union cannot possibly have more than one dozen A-bombs now and they cannot produce more than two dozen a year. I think that it is wise, especially in view of our recent underestimation of Soviet capability, to assume that these figures are lower limits. I think that it is more reasonable to assume that the Red bomb stockpile will top the one-hundred mark by 1952 and to lay our plans accordingly. Others argue that if we put too much emphasis upon civil defense now and no emergency occurs very soon, then people will lose interest in it and we will thus prejudice the success of effective defense at a later date.

Whatever your viewpoint or your estimate of Soviet capability, I think that it is high time that we did something about our civil defense muddle. But we must not proceed in a harum-scarum fashion. There is still time to analyze each proposed civil defense measure, to assess its effectiveness, and to plan for implementing it. In doing so there will always be a number of factors which will elude us. For example, one of the most critical factors in the defense of our cities is the detection of an enemy attack and the alerting of the populace.

If we get a one-day alert we can proceed with large-scale evacuation of the populace from the large cities. If the alert is only one or two hours, then all we can do is to have everyone seek shelter as best they can. Should there be no alert, the casualties will be a maximum. With a one-day alert casualties can be reduced to a few per cent. A one-hour alert may still allow the casualties to be reduced by a factor of two or by as much as ten under the most favorable circumstances.

No one can predict how much, if any, alert time will be given. Under this circumstance it seems reasonable to play it safe by evacuating our cities prior to an attack even though this may mean some false alarms. Certainly there should be some foreboding of an attack in the form of mounting international tension.

ACCESSIBILITY OF AMERICAN CITIES BY AIR, BY SEA, OR BY STEALTH

One reason why it is so difficult to predict the extent of an alert is that the Soviet Union can attack continental USA in a number of different ways. Too often defense planners have thought only of bomb delivery via the aerial route. This is, perhaps, a result of translating our own offensive position into that of the enemy. Many Soviet targets are deeply imbedded within the Eurasian land mass, well away from coastal approaches and tightly secured by an Iron Curtain. On the other hand, the United States has thousands of miles of shoreline; furthermore, it has no Iron Curtain. Our overstuffed American cities are accessible to attack by air, by sea, or by stealth.

A radar picket fence or an aircraft spotting system may be only partially effective in detecting an aerial attack, and it will be completely ineffective against any other means of delivery. If we consider only the aerial route, the Russians, according to Mr. Symington, ". . . are capable of delivering a surprise atomic attack against any part of the United States." Furthermore, the Chairman of the National Security Resources Board adds, "Today, the United States has no adequate defense against such attack."

During the next few years our military defenses may be bolstered; we will probably get more interceptors, more radar, and even a number of skysweeper guns for city defense. Interceptory guided missiles may make their appearance in about five years. But only an extreme optimist would say that the invading bombers can be intercepted successfully. When one considers a V-2 type missile launched from a submarine lurking a hundred miles off our coast, the possibility of military defense seems more remote.

Thus it would seem that the Soviet Union will soon have the capability of launching serious atomic attacks against continental USA. We, who have always in the past enjoyed territorial isolation, are now faced with the vicious threat of the A-bomb. Not knowing whether an attack will come next year or in ten years, we must prepare to live on the edge of peril. The prospect of living under the shadow of the bomb is a dread one; yet we must determine to prepare for the worst.

No one knows whether it is part of the Soviet war plan to bombard American cities with A-bombs. Fear of retaliation in kind might be expected to deter the Soviets through "mutual terror" as Winston Churchill put it, but there is no real assurance that it will. Should we ever relax our defense effort and allow our retaliatory forces to deteriorate, then we might suddenly find ourselves on the receiving end of a vicious attack. Or we might be lulled into complacency by a false peace and be rudely awakened by an atomic blitzkrieg. We must assume for purposes of planning that our cities will be attacked in a future war. In addition, it would be folly to assume that A-bombs will not be used in such a war.

EDUCATING THE PEOPLE TO THE REAL HAZARDS OF MODERN WARFARE

Now that we live in uneasy days, we must set about educating our people to the real hazards of modern warfare. The real hazards are something less than the lurid tales of universal destruction which are so often blared forth in the press. For example, there are rife stories that radioactive dusts or gases can be used to wipe out a metropolis. Theoretically, this is possible just as it is possible to kill everyone in USA with the sodium cyanide manufactured at Niagara Falls. But to lay down a uniform layer of dust over a city requires low altitude aerial tactics a thousand times more hazardous than delivering a single A-bomb. Washington takes the attitude that if you tell the average man the facts, he will either not understand them or will be panic-stricken. They say that the facts are secret and cannot be told.

Now that the Russians have the A-bomb, secrecy is a mighty thin excuse for stalling on civil defense. The argument that Americans will be scared stiff by the facts is palpably absurd, for they have already been exposed to far more hair-raising stories. The real facts will be somewhat of a relief. To withhold the facts because public officials feel that Americans cannot understand them is an affront to our democratic tradition. For only if we trust the American people and give them this problem will we ever arrive at a solution. Civil defense cannot be master-minded in Washington. The real problems are contentrated in our teeming cities, and it is here that the solutions must be found by the civic leaders and the man in the street.

The atomic threat to American security poses a multitude of new problems for us. Each problem must be analyzed objectively and viewed in relation to the whole complex of civil defense. To date we have not done this; instead we have gone off willy-nilly on training doctors for radiological defense and talked about Geiger counters as the answer to our problems. Unless we view each undertaking in proper perspective we will continue to go off half-cocked on weird approaches that will do little but waste time and energy.

Effective civil defense will not be a pleasant tea party or a congenial group of civic committees. Realistic defense measures will make inroads upon our established way of life. It will require personal and civic sacrifice. In the long run civil defense will alter the profile of city structure; it will completely re-orient the scheme of real estate values, and it will spell the end of the metropolis as we know it today. I believe that before this century ends we will see new types of communities, sleek ribbon-like strip cities no more than a mile wide yet stretching clear across a state. The sprawling metropolis with its tight cluster of sky-piercing buildings will be obsolete for the simple reason that it was too vulnerable to atomic bombs. How we proceed to transform our cities will depend upon our vision and courage. I hope that it will not depend upon our learning a tragic lesson in the broken stubs of our once proud cities.

SUMMARY

In summary, our civil defense headache centers in our large cities. To provide truly effective civil defense we must undertake before-the-fact preventive measures, such as dispersion over a long time, and evacuation in time of a threatened attack. Our basic strategy must be to have done our job before the bomb drops. Any civil defense plan which is based upon after-the-fact relief measures is doomed to be inadequate. The disaster of an atomic attack is potentially so great that it will overwhelm us if we wait until the bomb drops to go into action. There is no magic defense plan which will allow you to stay in a city and still be safe.

We may have to live in an atmosphere of international tension for years or even decades. As the years go by, the weapons of mass destruction will become more plentiful and more destructive. The H-bomb may make its debut. The means of delivery for these weapons will become swifter and more certain. In such a world we must be serious about civil defense, for it will constitute our national life insurance.

DISPERSAL IS GOOD BUSINESS

Tracy B. Augur

In the following article, Mr. Augur, Urban Planning Officer with the General Services Administration, discusses dispersal as a feasible and necessary measure for civil defense. The views expressed by the author are his own and do not represent the official opinion of the agency with which he is associated. Mr. Augur is a member and past president of the American Institute of Planners. Earlier articles of his on the problems of dispersal appeared in the Bulletin in May and October, 1948.

THE reasons for channeling the nation's urban growth into smaller cities and reducing the concentrations in the big ones have been stated so often that they do not need elaboration here. They can be summarized in two brief sentences. First, most of the big metropolitan communities, generally those that have passed the hundred-thousand mark, have so outgrown their basic physical structure and are so encumbered with obsolete plant and equipment that they can no longer perform their urban functions with genuine economy and efficiency. Second, they contain such large and concentrated masses of people and commercial, industrial, and governmental facilities that they offer very attractive and exceedingly vulnerable targets to any enemy seeking to cripple or destroy the power of the United States.

In short, the existing concentrations in our big metropolitan centers are economically unsound and dangerous, both from the standpoint of the nation at large and that of the cities themselves, and the situation gets steadily worse the bigger those centers grow. The United States, with all its wealth and power, cannot afford to let that condition continue. But the question may be asked, can it afford the alternative of effectively dispersing its urban facilities into smaller units? The cost of building new cities, or making substantial additions to existing small towns, is tremendous. Can the required outlay be made without upsetting the nation's economy?

ECONOMY OF NEW CONSTRUCTIONS

An answer to that question is suggested by a recent analysis of experience in the building of new industrial plants, reported in the April 1950 issue of *Factory* magazine. All of the twelve plants analyzed were built in the postwar boom period to expand or centralize operations, but not primarily to save money. They contained many modern features for the comfort of their employees; they were not stripped down to minimum cost. Yet the owners have found that savings in the cost of operating the new plants are sufficient to repay the entire cost of construction in from eight to twenty-five years—in more than half of the cases within fifteen years. Out of eleven plants reporting, output per worker went up 7 to 10 per cent in seven and 25 to 100 per cent in three. Only one plant reported no improvement.

Another indication of the economy of new construction is found in the increasing number of modern, well-planned suburban shopping centers that are being built to replace congested downtown facilities. Central business districts generally occupy the oldest parts of cities. Their form was set when the cities were much smaller and before the automobile and motor truck had become major factors in urban living. While individual buildings have been rebuilt or remodeled, the over-all plan and structure of the downtown business district as a whole is frequently unsuited to the needs of modern merchandising.

For that reason, many downtown department stores have found it necessary to supplement their central facilities with new suburban branches which can be serviced more economically and used more conveniently by their customers. Investors have found it profitable to develop complete new shopping centers at outlying points where modern provision can be made for automobile traffic and parking. Private enterprise has found that it is often cheaper and more profitable to build new urban structures for commercial purposes than to continue remodeling and using the old, just as it has found this to be the case with manufacturing facilities.

Cities, though generally far more complicated in their physical structure and operating arrangements, are comparable in many ways to the plants that serve commerce and industry. Most of the goods and services that modern society demands are produced in the cities—particularly in the larger ones. The cost of production is a composite of the costs incurred within the walls of offices and stores and factories: the cost of moving products and materials through the streets, the cost of commuting between home and work, the cost of public services such as supplying water and policing, the cost of living for the citizens, and many other items. All of these costs are affected by the physical condition of the city: whether it has a modern layout suitable for up-to-date operations or an obsolete layout that impedes them, whether it has efficient buildings, utility systems, streets, recreation facilities, etc., or old ones that are inefficient and costly to use.

We know from observation that the average city is worse off than the average factory in terms of the age of its physical plant and equipment and its general fitness to produce the goods and services that are needed today. With rare exceptions, city street systems were designed for an entirely different era, and such modernization as they have received lags far behind the mounting needs of motor traffic. The majority of urban buildings, both public and

private, are old and many of them totally unsuited for the uses to which they are now being put. The utility systems are a patchwork of old and new, generally just able to render the minimum service required for operations that are carried on at far less than peak volume or efficiency.

To the above may be added the familiar fact that the blighted areas of cities cost the cities far more in operating expense than they return in revenues. Because of their age and the conditions that accompany the use of old and out-of-date structure, they are a greater than average source of fires, crime, health problems, and other burdens on the public treasury and, for the same reason, do not accommodate enterprises that can bea their full share of taxes. This did not seem a very serious matter when it was first identified with limited slum areas, but it is now known that these conditions exist over vast areas of blight which may cover 30 to 40 per cent of a city's total area. Equally true, but less well recognized, is the fact that many new suburban areas are so badly planned and developed that they are financial liabilities to city, county, and state from the day they are opened to settlement.

The plain fact is that the physical obsolescence of the larger American cities is costing the country an enormous sum in excess costs just to keep the old plants in service. This is in addition to the daily losses to public and private enterprise alike that result from the inefficiency and delays of operations within the cities in question.

So it is reasonable to assume that if old cities were replaced with new ones, with modern layout and modern buildings and facilities in place of the old, the cost of the new plant could be repaid in a relatively short period of time from operating savings—just as in the case of new factories and new shopping centers. The savings would be spread among so many different operations and so many different people that it would be difficult to identify them and calculate their total, and there is no existing administrative mechanism which could recapture them and use them to amortize the cost of constructing new cities. Therefore, the case is difficult to prove statistically and must be deduced from parallel situations such as those cited.

CURRENT BUILDING NOT SOLVING CITY PROBLEMS

But even if one accepts the assumption that it would prove more economical and more profitable in the long run to replace old cities with new ones, there still is the question of where the money could be found for so great an investment. The answer to that question is relatively simple. The money is already being spent, to the tune of some twenty billion dollars a year. It comes from both public and private sources and is being expended on the whole gamut of buildings, utilities, and facilities that make up urban structure. Each year the American people are building over a million new urban dwellings and all that goes with them—the equivalent of a hundred new cities of forty thousand population—and they are paying for them through normal channels of investment and public expenditure.

But instead of grouping these new buildings and facilities to form new cities, they are building most of them in and around the old cities. By and large, the new construction is not making the old cities any more modern or any more economical to operate, either with respect to the governmental services or to the private enterprises that are carried on within them. On the contrary, it is just increasing the size and complexity of the problems which must be met with urban plant and equipment that remains basically obsolete despite the new buildings and facilities that have been scattered through it.

So to those who are concerned lest a broad program of urban dispersal place a heavy burden on this country's economy, it may be pointed out that their worries are misdirected. The real danger to the nation's economy lies in our failure to disperse, in our persistent effort to go on using old overgrown cities that have long since ceased to be operable on an efficient and economical basis. The threat is a double one because it involves fantastic costs of repair and remodeling—eighty-million-dollar traffic tunnels and forty-million-dollar bridges to cope temporarily with mounting traffic, for example—and because operations can never be carried on in such surroundings at a really high level of efficiency. The big cities are, in fact, a heavy drag on the nation's capacity to produce. They prevent us from reaching the productive levels and the cost economies that we associate with American business practice. They keep us from being the modern nation that we pretend to be.

Perhaps we could laugh that off in an era of peace and security; after all, we have a great fondness for antiques and could afford to go on using some of the old cities for sentimental reasons. But we cannot afford to treat the situation lightly while we are engaged in a life-and-death struggle to produce the materials we need to extinguish the spreading flames of world conflict. For that purpose, we need a modern urban plant that can produce goods quickly and economically. We can get it if a substantial share of the billions spent each year on urban construction is channeled into the building of modern cities. We can't get it if the money continues to go down the drain in a forlorn effort to make the old cities operate badly and expensively a little longer.

DISPERSAL WILL PAY FOR ITSELF

The dispersal of cities will pay its own way if it is given half a chance. The money is available to put it in effect on a large scale. It is the most effective measure of long-range national defense that this nation can adopt, and in the long run it won't cost us a cent of Uncle Sam's money or of the funds of private business and industry. Every penny put into it will be paid back in savings from greater economy and efficiency in the operation of our urban economy. The benefits to the health and happiness of our increasingly urban population are incalculable.

What we cannot afford is a continuation of our familiar practice of building up ever greater concentrations in the big urban centers; building elevated highways and traffic tunnels to relieve traffic congestion while we build skyscraper office buildings and apartments to increase it, spending fantastic sums of money year after year to make conditions worse. We cannot afford it, first, because the expenditure is unproductive. It may bring profits to a few, but the over-all picture is one of diminishing return from urban operations. We cannot afford it, second, because it increases our already great vulnerability to attack. And third, we cannot afford it because the money and effort is needed for a well-planned program of urban dispersal, which, if begun promptly and carried forward resolutely, can still stem the tide of mounting weakness in our urban economy and start building up the strength that we will need so desperately in the years ahead.

FIRE ASPECTS OF CIVIL DEFENSE

Horatio Bond

Mr. Bond, author of "Fire and the Air War" is Chief Engineer of the National Fire Protection Association. His analysis of the Hopley report appeared in the Bulletin in November 1949.

SO FAST have events moved, that the incendiary attacks on English cities in World War II are almost ancient history. We must draw on the English experience guardedly because the heaviest raid on an English city was of the order of fifty tons of incendiaries and high explosives. During most of the period of attacks on German cities, only the Royal Air Forces were in a position to be effective. The German cities were destroyed before the U.S. Air Forces were in the European Theater in force. During this part of the war, however, the Royal Air Forces frequently dropped bomb loads totaling one thousand tons or more on city targets. Over seven thousand tons were dropped on Hamburg. In the closing days of the war, the Royal Air Forces and the U.S. Air Forces made a much heavier attack on Dresden, an attack as heavy, if not heavier, than the A-bomb attack on Hiroshima. It is necessary to make this comparison of the respective weights of attack later in the war on German cities, as otherwise we might assign too much significance to conclusions based on the relatively light attacks on English cities. Yet we should not ignore the fact that damage occurred to one dwelling in five in England.

In England, Germany, and Japan, the structural damage was principally due to fire. In the cities of all these countries, investigations showed that fire was responsible for 80 per cent of the total damage.

The greatest loss of life in Germany and Japan was due to fire raids. The largest was probably in Dresden, but we have no figures on it. In other cities single attacks caused the following loss of life: Hamburg, 60,000; Wuppertal, 3,400; Kassel, 8,700; Darmstadt, 8,100. In Japan, fire raids killed 83,600 in Tokyo and an average of 1,830 per attack in 93 urban attacks before the A-bomb was dropped. The A-bomb loss of life was about 40,000 at Nagasaki, and 80,000 at Hiroshima. We do not need to pursue these statistics further. They are enough to show that large loss of life can be expected.

Wartime fires are different in one respect from peacetime fires. Peacetime fires usually start in one building and spread to others. Wartime fires start at practically the same time in many buildings. The fire area is extensive, and you cannot run fast enough to get out of it.

In England, scattered damage occurred, and complete burnouts were limited to a few blocks in any one city. In Germany, the areas of burnout reflected the much heavier attack: Hamburg, nine square miles; Wuppertal, three; Kassel, three; and Darmstadt, one and one-half. One raid on Tokyo burned out sixteen square miles. Other Japanese results were: Nagoya, eight; Kobe, three; and Osaka, two square miles. In ninety-three urban raids on Japan the burned-out area averaged nearly two square miles per raid.

SPREAD OF DAMAGE BY ATOMIC WEAPONS

The buildings at Hiroshima within a circle of two or three miles in diameter were destroyed or severely damaged by the A-bomb blast. The fire damage was chiefly inside this area. (There was some spread of fire outside this area because of the combustible wood construction of buildings and because the surrounding area was rather highly built up. Thoughtless observers are concluding that similar spread would occur in any city; however, we must be careful to note that the fire spread was due to the special local conditions. Similar fire spread would not have occurred in a German city where compartmentation by fire walls is the rule.) The burnout at Hiroshima was an area of 4.4 square miles. At Nagasaki (where local conditions were different) the burnout was 1.8 square miles.

The above is almost the whole of known information about wartime fire destruction. When persons talk about A-bombs larger than those used at Hiroshima and Nagasaki, or about H-bombs, about all they can do is to draw circles of damage which have larger diameters.

We have to plan civil defense measures to deal with a city where the center area is gone and where a wide ring of territory outside this center is partially damaged. Near the center the damage will be complete, and fires will probably destroy what the bomb blast does not. Toward the outer perimeter of this ring, there will be an extensive area in which damage from blast will be slight and where there will be some chance of dealing with fires.

It is apparently possible to design a bomb of any size. There is no sense in making a bomb too big—it doesn't need to be any bigger than necessary to wipe out a target city. If an H-bomb can be built which will produce an area of destruction with a forty-mile diameter, almost any existing city of 300,000 population can be destroyed by one bomb. The bomb will be big enough to destroy many cities where a larger population is crowded into a forty-mile circle.

ACTION IN FIRE DEFENSE

It is important that we know what kind of situation we are likely to be up against in order to plan effectively for civil defense. The foregoing re-

cital of the principal facts about the fires of World War II enables us to narrow down a bit the field of possible action. I shall discuss possible action under four subject headings: (1) measures to reduce the vulnerability of city and industrial targets; (2) arrangements for water supply for fire fighting; (3) first-aid fire fighting (the fire guards); and (4) fire fighting by public fire departments. Most of the other problems of civil fire defense are collateral to one or another of these subjects, and in viewing these four items we can have a pretty good look at the whole problem.

DEFENSE BY SPACE

It should be clear that with cities and industrial plants as they are, there would be no difficulty in destroying them. They could be destroyed with incendiaries and high explosives even if the A-bomb were not a reality and even if the H-bomb could never be built. As they are, we have to make up our minds to lose them. The question is, should we try to do anything about our cities? The objection is usually raised that nothing worth while can be done. Let us examine that proposition.

Assume that an enemy has an atomic bomb or any other large bomb. The same general principle applies. He looks at the cities of New York and San Francisco and notes that any bomb which he can deliver has an excellent chance of killing a lot of people and destroying a lot of buildings. Manhattan has a daytime population density of some 145,000 per square mile. On the other hand, he looks at Los Angeles and Houston. These cities are not nearly as attractive as targets. They are so spread out that many bombs would be needed to accomplish the same destruction a single bomb might do on Manhattan. An enemy is going to pick and choose his targets, and, if they are hard to destroy, he may decide that they are not worth the effort.

Consequently, we have the one very practical defensive measure, the use of space. If we are willing to space out our buildings, we can avoid the concentrations of people and buildings which lend themselves to ready destruction.

The National Security Resources Board, which is an agency advisory to the President of the United States, is charged with responsibility for civil defense planning. One of its first publications on the subject was entitled *National Security Factors in Plant Location.*[1] This outlined a realistic and practical approach to the problem of industrial dispersion as a defense measure. This brochure offered no radical or hysterical program. It said, in effect, that concentration of industry in the future must be avoided. It did not suggest that existing plants be uprooted and moved. It did point out that, in the normal course of things, industry would be planning new buildings and new plants. It recommended that whenever a new building was to be built, it be built with a space separation from existing plant structures. When extensive plant enlargements were considered, it asked management to study the possibility of locating the new facilities away from existing congested industrial areas.

The same approach should be applied to our congested cities. It will be proper for our military establishments to veto further concentration of urban centers. No more skyscrapers. No more congested housing projects. If slums are cleared, leave them clear. Build new buildings in such a way as to keep down the concentration of people. By these measures we may get more comfortable cities, not to mention badly needed parking space between buildings.

The amount of space needed for defense is a great deal more than most people are willing to accept. Until we know the destruction which can be caused by the large A-bombs and H-bombs that are being talked about, the amount of space required is largely a guess. However, if we could get an acre of open space for each family unit, we could set up a situation where the community would no longer be an attractive target for any bomb except one of phenomenal destructiveness. No bombing is considered worth while if a large part of the effectiveness of the bomb must be wasted on open space in order to destroy a target.

A good many cities now require that dwellings in the best residential sections be built on lots not smaller than an acre. The application of an open space rule could be applied so that even multiple family dwellings or skyscrapers could still be built. It would be necessary to set some limit on the total number of persons to be allowed in any one location, but if there were a large open space around each apartment building or office building, the objective could be attained. It would make our cities look different, but the idea of a city of skyscrapers, each surrounded by a large open area, is not an unattractive prospect.

Between now and when the first bombs are dropped in another war, our cities will either become better and better targets or we will make them so undesirable as targets that an enemy will be forced, by the economics of the situation, to leave them alone. We have lost six valuable years during which the process of congesting cities has gone merrily on. We need a statement from our military establishments to the effect that this process must be reversed. If the military people do not act, I think city authorities sooner or later will do so. They have ample machinery to do this through city planning measures, zoning restrictions, and building-code administration.

WATER FOR FIRE FIGHTING

A lesson of the bombings of World War II is that if you expect to fight fires which are caused by bombs, you must have a water supply in which the water for fire fighting is stored near the building on fire. Water supplies from conventionally designed public water systems are interrupted by the bombs which fall. As a principle, therefore, we cannot rely on any system in which water is piped over long distances. At Hiroshima, the public water supply was made useless by the large number of broken service connections, the flow from which depleted the supply.

This is a matter to which almost no thought has been given and to which the operators of the public water utilities seem to have a blind spot. There has been hardly any discussion of the subject among water works people. It is high time we did a little realistic thinking about it.

Most people assume that we will be able to do something which was done in England and Germany and to some extent in Japan: provide static water sources by means of tanks in streets, reservoirs in cellar holes, and access points at streams and ponds for pumper suction. There is no real appreciation of the difficulties of a practical and technical nature in building and maintaining these alternate water sources. Such measures as were undertaken in World War II were in the nature of makeshifts, and the individual schemes have had no thorough study by persons on this side of the water. The first step, therefore, is a study and appraisal of these wartime measures.

As a principle, water supplies must

[1] Summarized in *Bulletin*, IV (October 1948), 316-17, 320.

be provided in which all of the water needed for fire fighting is stored near the property for the protection of which it is provided. This principle is often followed in the protection of industries and therefore isn't as radical as it may sound. A wartime water supply for industrial fire protection would be something as follows: There would be a gravity tank with a generous supply of water to supply sprinklers or hose streams in the early minutes of fire fighting. A large storage tank would be a secondary supply, providing water for fighting a fire of several hours duration. Sprinklers would be very desirable, as they conserve the use of water. If the plant is blown down by bomb blast, the plant is destroyed anyway. If, however, the plant is in an area of partial damage, the sprinklers are likely to be still in service. If the gravity tank is blown down, the ground storage of water may be intact, especially if an underground reservoir or a pond is the source of storage provided. To guard against power failures, at least one fire pump, gasoline engine driven, could be provided which would assure the availability of the water for fire purposes.

Note that all these measures are simply adaptations of proven methods of peacetime fire protection and are desirable in peacetime as in wartime. One possibility is that the mercantile districts of cities should be protected by water systems like these industrial layouts described. By having a separate system for each block, or for each group of blocks, unreliable features of conventional systems would be overcome.

By providing such local storage, peacetime fire protection of a superior order could be achieved so that the measures would not be wholly an economic waste like most features of wartime preparedness. For first-aid fire fighting, the large local reserves of water would be supplemented by numerous smaller tanks from which buckets and pump tank extinguishers could be refilled.

THE NEED FOR FIRE GUARDS

In dealing with wartime fires, first-aid fire fighters, the fire guards, were important. In England, for example, many buildings were saved by resolute fire guard teams with stirrup pumps and buckets, and occasionally small hose stream equipment. Since with any large bomb there is likely to be a large area of partial destruction in which fires will occur, it will be worth while for every property to have its fire guards. The value of these teams is that they are likely to be right on the job when the bomb hits.

In England, the fire guard service was numerically the largest civil defense agency. It was principally organized for night duty because

the incendiary attacks usually came at night. The fire guards eventually became a permanent force, with team members paid for the hours of service. Also, the fire guard service was completely independent of the regular public fire services. I think this latter principle would apply to any fire guard scheme for another war, because the fire guards are a group of different people than the regular firemen, and the teams were not designed to be mobile in the sense that a fire company is mobile. I do not think we have evidence yet to determine whether all fire guards should be expected to serve round-the-clock and whether it will be necessary to organize them into a formal service. There will be some important properties where round-the-clock first-aid fire-fighting service will be appropriate.

This is a field in which we can make an effective start in peacetime. There is no waste effort in increasing the number of people who know how to use a fire extinguisher or a pump tank.

In wartime fires in a bombed city there will never be enough public fire fighting companies available. In general, the public fire departments will have to make a selection of the fires which they will try to reach and attack. Because they can reach only a fraction of the fires, the principal fire fighting will necessarily have to be done by the fire guards.

PUBLIC FIRE DEPARTMENTS

I have left until last the discussion of public fire departments. These are emergency organizations and, whatever the emergency presented, will give a good account of themselves. However, in assigning a decisive role to public fire departments in civil fire defense, we would be making an important error. Fire departments are simply not a wartime fire-fighting organization. They are set up in the expectation that they will have to deal with only a few fires at a time. At Hamburg, a pre-A-bomb fire was burning on street fronts totaling 133 miles. The Hamburg Fire Department was one of the best in the world. The resultant destruction would have been little different if it had not existed. Mobile fire fighting units provided by the government were available to aid the local fire forces at Hamburg. Even what seemed to be a hugh mobilization of fire forces did not appreciably affect the result. With the greatly increased potentialities of destruction in modern bombs, the idea of mobile fire forces to augment the existing forces in any city is simply a totalitarian dream. One of the surest ways to lose a war would be to tie up manpower in such an essentially useless force.

We have got to reconcile ourselves to a large area of destruction in any location bombed. Our efforts should be directed to preventing needless loss of essential services, and the public fire service should not be used up in dealing with hopeless fire situations. It makes sense to put municipal fire stations in the fringe areas of the city rather than in the center. It is desirable to give fire departments good communication facilities so that they can disperse their forces to locations where they can do some good. We should examine the organization, training, and equipment of fire departments to make sure they are effective organizations.

In conclusion, I suggest we approach the fire problems of civil defense in the following order of their relative importance.

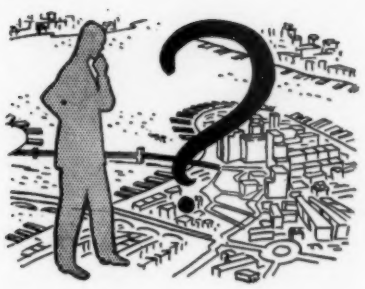
1. Measures of city planning to reduce vulnerability.
2. Water supplies for fire fighting.
3. First-aid fire-fighting arrangements through organization of fire guards.
4. Fire Department organization.

Related subjects, such as equipment, training, and communications, which I have not taken time to discuss, will, by this approach, receive proper but not disproportionate attention.

A MAYOR LOOKS AT THE CIVIL DEFENSE PROBLEM

Frank P. Zeidler

The author of this article on municipal organization for civil defense is Mayor of Milwaukee, Wisconsin, a city which is well advanced in its protective preparations. Copies of the Milwaukee Plan were sent for guidance to the mayors of other American cities early this summer.



POSSIBILITY of Atomic Attack Speeds Suburban Movement—reads a recent headline in a Milwaukee newspaper. The story reported a study made by a nation-wide real estate organization on the impact of the atomic era on real estate purchases.

The census of the Milwaukee metropolitan area confirms the current trend of flight from the central city. Although the impelling force in this flight is more than just the fear of an atomic explosion, nevertheless, the thought of abandoning the main city and of fleeing to suburban areas has occurred to nearly every mature person. News stories, such as the one mentioned, continue to spur the movement.

In some instances the instincts of the average mind are better weather vanes than are the official policies of government. The popular belief concerning the danger of living in cities in the atomic age may be such a weather vane. The prevalent wave to escape the cities formed a principal spur to the formation of a civil defense group in Milwaukee. The experience of this group may be valuable in an exposition on civil defense problems of cities generally.

THE ORGANIZATION OF CIVIL DEFENSE IN MILWAUKEE

In June 1948, I called together a group of experienced men to form the Milwaukee Civil Disaster Relief Committee. It was apparent that, in both peace and war, the concentration of many individuals living closely together always enhanced the possibility of disaster. This fact is now particularly true because of the numerous forms in which high-energy materials are stored and used.

The storage of petroleum products, the use of gas (manufactured and natural), and the widespread installation of electrical appliances make a combination of disaster-producing elements. If these are combined further with certain atmospheric circumstances or with certain psychological factors, the catastrophes to humankind can reach substantial proportions. The Texas City disaster, as a case in point, was an example of how the combined factors of an explosive material plus the presence of sightseers, the psychological element, can bring death to hundreds.

To describe the change of the Milwaukee Civil Disaster Relief Committee to its present form, the Milwaukee Civil Defense and Disaster Committee, would produce a tedious recital. A principal cause of the change, however, was the conclusion reached by practically all members of the committee that sudden atomic warfare is possible. A further conclusion was that all the larger cities are principal targets in any future war.

The first series of meetings resulted in an organization approximating that recommended in the Hopley report on "Civil Defense for National Security," which was transmitted to the office of the Secretary of Defense on October 1, 1948.[1] With some variations, our present pattern of organization now conforms closely to the Hopley pattern.

In constituting our committee, however, we had little help outside of the Hopley report. We therefore took to speculating about the types and probabilities of disaster striking our cities, and at what time or under what conditions they might occur. This consideration was and is necessary in order to evolve a pattern of operation.

We decided on these basic principles:

1. Any civil defense and disaster plan must provide maximum protection to the lives and properties of the citizens of the community.

2. Any such plan must be sufficiently flexible so that it can be adapted quickly and effectively to meet various possible situations.

3. Any such plan shall disrupt the normal functions and the activities of the civil government to the least possible extent.

4. In any such plan the normal divisions of the civil government shall be utilized to the fullest extent rather than replaced by separate or extraneous agencies.

5. A community must plan to depend as much as possible on its own resources as to personnel, material, and basic community organizations. Self-help shall be emphasized in all phases of this plan.

6. A community must be prepared to give assistance to a stricken neighboring community promptly and effectively.

7. A community plan must necessarily fit into the national and state plans of civil defense.

8. Any civil defense and disaster plan must develop confidence in the citizens of the community and help maintain

[1] See *Bulletin*, V (November 1949), 295-97, 314.

We wish to thank the Regional Plan Association, Inc. for permission to use the cut on this page.

their morale at the highest possible point.

The principles outlined above enable our present organization to cope, at least theoretically, with a flash flood or a major conflagration. We utilize the standard services of governments up to their saturation point and then call on a corresponding part of our defense set-up to supply the additional demands. In the case of a flood which put our main water pumping station out of order, we called upon the Fire Department to supplement pressures and upon our information service to inform users to cut down supply. In the case of a rooming-house fire which made scores homeless, the Red Cross, working in liaison with the Fire Department, took care of the needs of the distressed. Our committee therefore thinks it has established a successful pattern for the minor contingencies.

In considering the problems of major disaster—wartime disaster chiefly—we have studied our needs from the point of view of self-help. Without strong direction from government and without much information other than that gleaned from periodicals or other written sources, we sense our unpreparedness and fear that if an enemy should engage us in war, America's cities will be in great peril.

Accordingly, we have changed the emphasis of our civil defense thinking. We are considering what to do if a possible enemy delivered a "Sunday punch" in the very near future.

The state of national defense being what it is, one thought occurred to us: We must plan for a program of evacuation, since distance from the target appears to be the principal defense from atomic attack. This program must consist of an emergency warning system, a pre-warning evacuation plan, a post-warning plan, a defense of those who remain, and methods of re-entry.

Planning of this sort led us to the question: "Where do we stand in relation to other units of government on strategy, planning, financing, and organizing?"

TWO IMPORTANT QUESTIONS ASKED OF JOINT CONGRESSIONAL COMMITTEE

Early in planning and organizing, the Milwaukee Civil Defense and Disaster Committee ran into difficulties. These difficulties are best illustrated by a series of questions put to the Joint Congressional Committee on Atomic Energy on April 3, 1950. The questions were put by Dr. George A. Parkinson (Captain USNR), Deputy Director for Administration, Milwaukee Civil Defense and Disaster Committee, at my request:

"Is the Federal Government going to take a firm position in developing national and state patterns of civil defense which will make it possible for cities and large industrial areas to do the job which must be done in their own communities?"

The public is now informed that a plan is in preparation for release in September .

Next, Dr. Parkinson put the principal problem:

"We are asking that we be advised as to whether top echelon thinking here in Washington feels that the large urban areas in this country can or cannot be defended against high concentrations of strategic bombing or atom bomb attacks."

Although it is the hub of our whole problem, the answer to this statement has not been given. If cities cannot now be defended, the logical step is to abandon them or to rebuild them quickly.

REARRANGEMENT OF CITIES PRACTICABLE FOR THEIR DEFENSE

Digressing somewhat, I must say a mayor of any large city will take, of course, an exceedingly dim view of any concept which says cities cannot be defended but that the public should not be told. Either there must be an advance in defensive methods which can destroy atom-bomb carriers, or cities must rearrange themselves. Cities might be more defensible if they rearrange themselves into long ribbons and break up the ball-shaped form target which they now present. The pattern of destruction of any explosive force is essentially a circular one. A circular pattern of destruction, superimposed upon a circular community, must necessarily cause great destruction. However, a circular pattern of explosion, superimposed upon a ribbon-shaped city, may but poorly justify the expense and energy used in delivering the explosive. Consequently, I believe it is vital for cities to adopt for themselves a plan of ribbon-shaped development as quickly as possible.

In any event, this pattern seems to be forming under the influence of the modern highway and the improved motor vehicle. It seems to me entirely possible that the studied attempts on the part of cities to channel their growth into narrow ribbons will produce a pattern of high security not hitherto thought possible. It is not likely that anything but sad experience will hasten this process.

Several suggestions concerning the developments of cities in the new era already have appeared. One is this ribbon development in which the wedge-shaped areas between the ribbon strips are used for parks, playgrounds, airports, farming. These latter uses would keep down the densities, provide necessary facilities near residential areas, and provide fire breaks.

Another similar pattern provides for small ball-shaped communities spaced at two-mile intervals. To break up large cities in this way will require a break with established patterns and traditions.

Returning to the questions asked by Dr. Parkinson, a third request was stated as follows:

"We are asking to be advised of the type of warfare and type of weapons against which we should plan to protect our communities."

Concerning these weapons there is some certain knowledge and a great deal more speculation. The object of defense is to reach a stage of dispersal where bombing becomes expensive without any loss in the city's capacity to defend itself against biological warfare. However, since no direct statement of protection against biological weapons has been forthcoming, cities are left to devise their own defenses against something they know little about.

A civil defense pattern could thus conceivably be devised which would have no value whatsoever.

Dr. Parkinson asked a fourth question:

"We are asking to be advised as to how best we can proceed during the development of our own organization without inciting mass hysteria in the light of current publicity being given to A- and H-bombs. Perhaps if the right amount of appropriate publicity is promulgated, many excellent ideas will come from the people themselves as to how best to meet these dangers. This has always been true of America in the past. It is reasonable to expect that it will continue to be true in the future."

This question has been answered for us in the attack of the North Korean government on the South Korean government—an attack that has served to instill in many persons the firm conviction that there is no longer any other alternative to a steady, rapid expansion of full civil defense.

Prior to this event, however, most

cities and most heads of cities were indifferent to civil defense. If the question of defense were raised, the public attributed it, in some instances, to alarmist sentiment. I have heard a number of mayors privately express the feeling that they could not move on this subject because the public in their cities would not permit them.

Even the publication of the Hopley report did not create enough local sentiment to stir more than a few cities to start defense organizations. The Federal Government, too, lost precious time in tackling the problems in a direct manner.

THE NEED FOR A NATIONAL AND STATE ORGANIZATIONAL PATTERN

A fifth question was raised by Dr. Parkinson at our suggestion:

"We have one further request to make, and that is, that some sort of national and state pattern of organization be set up so that a large urban area will be treated as such, with due regard for the technical skill, equipment, and facilities which are available in the city itself, and which, in many cases, are not available to the surrounding governmental units. It is well known that some of the governmental units, schematically superior to the city—as for example, the county governments—can, and even might, stifle the development of appropriate, reasonable civil defense organization. We are asking how this problem can best be handled in order that full use may be made of the resources of the city as the central core of the region."

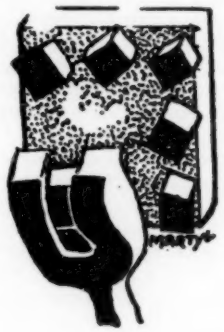
Dr. Parkinson further added:

"That is exactly your problem, and it is exactly our problem. Actually the cities are the central core of what I call 'high disaster potential' and this drops off as you go away from this central core. All of the region, however, is involved in the problem, but the center of gravity—of technical ability and facilities—rests within the city."

The Milwaukee Civil Disaster and Defense Committee found that in dealing with the 1949 Wisconsin legislature it ran into opposition. Some persons viewed proposed legislation for statewide civil defense as an infringement on basic civil rights. The Korean incident found the State of Wisconsin with only one officer—and he working on a voluntary basis—trying to meet the problem of state-wide civil defense.

Under these circumstances, the proposals of the National Security Resources Board to transmit vital information to state governments, which would then transmit it to local defense authorities, has not worked out well. Partly at my suggestion, the U.S. Conference of Mayors passed a resolution requesting the National Security Resources Board to transmit vital information directly to the mayors of the larger cities, as well as to the governors of the states.

As an example, it would be cumbersome and the delay costly, if the Chicago area, under attack, had to appeal to the Cook County Defense Committee, which would in turn appeal to the State of Illinois Defense Committee, which in turn would appeal to the State of Wisconsin Defense Committee, which would transmit the message to the Milwaukee County Defense Committee, which would in turn transmit the information to the Milwaukee Civil Defense and Disaster Committee that the City of Chicago needed the Milwaukee mobile reserve.



A further important obstacle to ideal city defense is that small communities are uniformly, and justifiably so, affected with a local pride that resents any interference from the large cities. There is a tendency, therefore, for a lack of harmony to prevail between the large cities and the surrounding communities—particularly if a swarm of refugees from a stricken area should pour out into the countryside. This pattern of resentment apparently occurred both in Great Britain and in Germany, and there is no reason to expect otherwise in the United States.

THE SUGGESTIONS OF THE MILWAUKEE COMMITTEE

In asking the five questions of the Joint Congressional Committee on Atomic Energy, the Milwaukee Civil Defense and Disaster Committee had some answers of its own to these questions.

Dr. Parkinson stated:

1. "We suggest that the Hopley report should be promulgated as the basic standard for the development of the civil defense organization, at least until such time as a better plan has been prepared."

Dr. Parkinson commented further that it was our feeling that this operating plan could be improved, but that in the meantime it was the best plan that has been developed.

Dr. Parkinson further said:

2. "We suggest that there should be set up a central office of information which would constitute a clearing house for ideas in the development of the various civil defense patterns throughout the country. We feel that no single community can develop the best civil defense pattern within itself. No one city will have all of the best ideas. Each community can and must tailor its program to meet its own local needs, but should be advised of the very excellent ideas and developments which are taking place in other communities.

3. "We should like to suggest that a study be made toward the standardization of procedures and equipment of various municipal organizations, such as fire departments, departments of public works, and public health departments, so that the communities could interchange services and activities, and so that even vital materials and equipment could be transported from one community to another by air or other rapid transport and be immediately useful in that community.

4. "The last suggestion which we would like to make has many important ramifications, both political and financial, and that is the question of decentralization of governmental functions, industrial activity, and housing facilities. We believe that there should be a study on the national level which will give local communities some of the answers to the problems in this area.

"To what extent should a city plan to decentralize its governmental activities; to what extent should its utilities be put underground or decentralized; to what extent should private industry be urged to decentralize its activities and factories; and what should be the guiding principles which should govern the construction of public and private housing? Attached to all of this is the basic problem: Who is going to pay how much for what?"

The question of decentralization can be solved if cities determine on a ribbon pattern. The ribbon pattern of development, or any other pattern, takes time to formulate, and cities should have some concept of how much

(Continued on page 286)

LESSONS FROM THE LAST WAR

Marc Peter, Jr.

Mr. Peter served as Civil Defense Attache at the U.S. Embassy in London from 1942 to 1945. He has recently been invited to serve as a member of the Air Force Scientific Advisory Board on the panel for explosives and armament.

present stage of U.S. civil defense, a review of past experience with organization and policies will prove rewarding. Of particular significance was the evolution of civil defense relationship with air force.

WHETHER or not civil defense experiences of the last war are applicable or relevant to atomic attacks is a legitimate question. Certainly the aim of air attacks, i.e., the destruction of the enemy's productive capacity and the shattering of civilian morale, is not altered by the choice of bombs; nor is the function of civil defense, which is to minimize the effects of the attacks. Neither can it be argued that the extent of atomic damage renders all past experiences useless, for many of the large conventional raids presented problems quite comparable in size to the effects of atomic bombs, except for the new and therefore fear-inspiring danger of radioactivity.

From 1939 to 1945, under the impact of air attacks, Civil Defense evolved, in states exposed to these attacks, from the initial vague concept of "Passive Defense" and "Air Raid Precautions" to the hard and fast system whose primary aim became the rehabilitation and restoration of the damaged civilian economy to the necessary level of war productivity. This concern with civilian ability to contribute effectively to the war effort is indeed the true criterion by which civil defense organization and operation must be judged. In the scheme of things called total warfare the restorative function of civil defense assumes at times heroic proportions likely to cause a serious drain on the country's resources. Careful planning is required, therefore, lest civil defense becomes an end in itself instead of the means to prop the civilian war effort under fire.

THREE OUTSTANDING FEATURES OF THE LAST WAR

Necessary to the understanding and appreciation of civil defense experiences are three outstanding features of the last war. The first is the amazing fortitude of the civilian population under air attack. Neither panic nor wholesale displacement occurred. Civilian morale and self-discipline remained at a high level even in those parts of Germany and Japan which suffered the brunt of allied attacks. Thus, any civil defense plans which place over-emphasis on repressive and disciplinary measures are likely to backfire and to be out of line with the facts.

The second is the overriding problem of manpower shortage. All belligerents, except this country, were forced to resort to total mobilization where all adults were directed or drafted into those activities where they best fitted, following priorities established to insure national survival. Accordingly, the civil defense establishment of Britain and Germany gradually tended toward the use of a minimum number of full-time and highly trained personnel, exempt from other war work and sometimes grouped in mobile units. The luxury of millions of volunteers is a by-gone concept in conflict with the realities of total warfare. Civil defense must be planned to discharge its function with a minimum of means.

The third feature is the great resiliency and flexibility of the civilian economy which has proven under attack to be capable of withstanding substantial amounts of physical destruction and casualties without fatal impairment of its war productivity. Thus, to cripple civilian economy to any significant degree has required sustained and repetitive attacks. Civil defense plans, organization, and operation must take this fact into consideration.

The lessons of the last war in the field of civil defense are by no means all in the operational area whose details depend on circumstances or conditions not susceptible to generalization. In the

THE AIR FORCE AND CIVIL DEFENSE

One of the chief responsibilities of air force toward civil defense is a sober appraisal of enemy capabilities, i.e., specifically speaking, the probable range and direction of enemy attacks in the light of the disposition and extent of its available forces, the probability of interception and detection of enemy attacks, and the type and weight of enemy weapons. This appraisal, furthermore, should be subject to constant review as new intelligence comes to the fore. Civil defense cannot be planned and organized to meet all possible contingencies; the effectiveness of its measures depends to a great extent on their being geared realistically to the risk of damage and casualties estimated by air force. To be sure, the availability of this intelligence on enemy capabilities to civil defense personnel involves a serious problem of security, but by no means is it insuperable. Both Britain and Germany solved it successfully in order to concentrate their civil defense forces economically at points of greatest vulnerability.

Information on new weapon developments should be made available to civil defense to allow for revision of its plans and measures. In England, a special branch of the Civil Defense establishment assumed the responsibility for measuring damage, physical and economic, in order to provide the Royal Air Force with a quantitative assessment of the effectiveness of bombs and tactics, as a sound basis for the development and selection of these. As far as the atomic bomb is concerned, the relative effects and extent of radioactivity (gamma-ray and gas-cloud), blast, earth shock, and fire flash depend on height of explosion and size of the

bombs. Both will be probably selected by the attacking air force on their estimate of the ability of civil defense to cope with the consequences of the explosion. In the last war, RAF area tactics were specifically designed, in the light of British experience, to overwhelm German civil defense.

Blackout in Europe proved most effective because of the proximity of enemy bases and the tactics of area bombing; but, like camouflage, smoke screens, and counter radar, it is essentially a deceptive measure of primary concern to the air force. Standards and operation of blackout, including design of equipment and timing of operation, should be determined by the air force, particularly if the inept confusion which attended its planning in the early stages of the U.S. Office of Civilian Defense is to be avoided. Blackout enforcement is best left to local police authorities.

Civil defense should also be freed from any responsibility in connection with detection of enemy aircraft, which originally was accomplished by volunteer spotters. The use of radar screens requiring skilled full-time personnel, and the fact that the primary purpose of detection is to help interception by planes and anti-aircraft fire, places it squarely under the responsibility of the air force. Only the operation of sirens and other warning signals is a legitimate function of civil defense. The practice in both England and Germany was to sound warnings over as small an area as possible compatible with the risk, thus minimizing interruptions in factories and losses in production. The casualty rate per ton of conventional bombs, either high explosive or incendiary, however, is much lower than the rate produced at Hiroshima or Nagasaki, and to minimize atomic bomb casualties will undoubtedly require a longer warning period to allow for sheltering of the population. This, of course, is sheer conjecture; the only lesson to be drawn from past experience is that both timing and area of warning cannot be automatic but must depend on the composite judgment of both air force and civil defense personnel as to chances of interception and local conditions of targets. Brief disruptions of vital production schedule may well be an unimportant consideration under atomic attacks.

RAIDS DESIGNED TO OVERWHELM CIVIL DEFENSE

The first raids in 1939 and 1940 were rather leisurely affairs. Following a strike, the warden or policeman reconnoitered and reported the facts of the incident to a comptroller who dispatched the necessary services. As raids became heavier and the ground density of hits greater, this procedure became inefficient, and an incident officer was put in charge of an area containing multiple hits so that services were coordinated and priorities of action immediately established. Later, British and American attacks over Germany and Japan dumped a few thousand tons of bombs within a relatively short time, with resulting coalescence of a large number of contiguous incidents into vast areas of damage and roaring fires. To cope with this type of damage, specifically designed to overwhelm civil defense facilities, required the setting up of field headquarters headed by the top "brass."

The interesting thing is that the basic lines of operations remained the same irrespective of the size of the incident, which at its largest was comparable to the atomic damage of the two Japanese attacks. The pattern of operation followed three distinct phases. The first was saving of lives (removal and treatment of wounded, rescue and evacuation) and containment of damage (mostly fire fighting). The second was sustenance of life and repair of vital facilities. The third was rehabilitation and restoration with emphasis on war production and civilian morale. Depending on conditions, these phases were more or less synchronous and called on the facilities of *all* agencies and departments of the civilian government, local or national, of the civil defense services, and of the public utilities. The size of the incident affected the extent of their activities but not the number of the participating agencies or services.

TOTAL AND IMMEDIATE MOBILIZATION OF CIVILIAN GOVERNMENT MACHINERY NECESSARY

Without going into detailed description of operations and their sequence, a few general characteristics emerge from the above. Civil defense is the concern of the *entire* civilian governmental machinery mobilized and trained to repair the damage promptly. Even Treasury or Social Security, for instance, which would seem only remotely concerned with the emergency, must be on hand *at once* to replace monies and records so that civilians may be restored as soon as possible to a degree of self-sufficiency necessary for the discharge of their war duties. The complexity and specialization of modern civilian life imposes on the responsible officials at times of emergency a high degree of executive skill and an intimate knowledge of local conditions if the job of rehabilitation for war purposes is to proceed smoothly and fast.

British and German experience agree and support the thesis that civil defense is best organized by extending for emergency purposes the activities of the existing authorities at all levels rather than superimposing a parallel and autonomous organization which at times of action would conflict with the established authorities. The point at issue is that once the damage is done, the civilian government, particularly on the local level, has only one concern and one field of activity, the rehabilitation of the damaged area. The legal and constitutional responsibilities and prerogatives of duly elected officials and their appointees cannot be ignored, nor can political territorial limits be forgotten. The problem, somewhat difficult politically, is one of coordination and cooperation.

In the early planning stages of European civil defense, because of the apparent similarity between post-raid and army operations, recourse to the armed forces was thought desirable. The same idea was entertained in this country, and the so-called protection services of the Office of Civilian Defense were staffed with retired army officers. British and German practice show that army personnel do not possess the knowledge of civilian government procedure and local conditions necessary for civil defense operations. In practice, very little, if any, recourse to army personnel was made in either country except for extra manpower for rescue, repair, and hospital services. Thus, emergencies were handled in a civilian way by civilians without the trappings of martial law and disciplinary procedure. A spirit of civilian self-reliance and pride was thus developed which proved essential in meeting extreme emergencies.

PROGRAM AND PERSONNEL COORDINATION A MAJOR TASK

In the early stages of civil defense, coordination of programs and personnel at all levels and between local and national agencies proved a major task. In the operational stages it was found that national executive functions needed decentralization nearer the point of damage and that local authorities needed help and supervision. Both the British and the Germans created *ad hoc* agencies at the regional level headed by a commissioner with wide executive pow-

ers. His staff consisted of representatives of the national departments and agencies plus a number of inspectors responsible for liaison with the local and, in Germany, the provincial authority. Policymaking and directives were left to the national departments, the commissioner's duties in the pre-raid stages being confined to coordination and implementation of standards with the right of modification to meet special local conditions. After the attack, the commissioner was to all intents and purposes the top civil defense executive, acting through the established authorities or superseding them if incompetent, his powers being derived from what in this country would amount to a delegation of the emergency war powers of the President. In practice, the history of large raids, particularly in England, shows that the local authorities successfully met the test of emergency within their competence. Nevertheless, the authority of the commissioner was necessary to back and prop up the local officials. In many occasions the commissioner acted vigorously.

In other words, Britain and Germany found necessary the concept of dual responsibility of civilian authorities, whereby they act autonomously in the pre-raid stages with a minimum of interference from above, but in the post-raid stages are part of a definite and strong chain of command headed by the commissioner. In the U.S. where there is no direct line of authority between federal, state, and local authorities, a different organizational pattern would have to be created to meet the requirement for decentralized emergency power at a level higher than local authorities. The state governors are the logical candidates to fill the role of the British commissioners. A federal official on the governor's civil defense staff and with broad emergency powers over all federal agencies would be necessary to complete the necessary planning and executive coordination of these agencies at state and local levels.

MUTUAL AID AND ORGANIZED, FULL-TIME SERVICES ADVISABLE

The recurring keynote of all large-scale attacks, and it would be even sharper in the case of atomic damage, was that the services of the damaged area were *not* sufficient to cope with the emergency. It had to draw on mutual aid from the outlying territories for relatively long periods after the attacks. Casualties among the local services lowered their efficiencies, and these must be expected to be higher under atomic attack. A feature of post-raid work is the long drawn-out, exhausting operation of the civil defense field services such as rescue, demolition, medical, food, shelter, information, etc., working around-the-clock in shifts without let-up. The use of mutual aid immediately introduces the problem of command and organization of these field services.

On the basis of the experiences of the last war and of the evolution in British civil defense practices, especially with fire-fighting services, the best solution lies in the formation of mobile columns of highly trained shock troops under the command of an echelon higher than the local authorities. These columns should be stationed at nodal points, in constant readiness, and should be self-sufficient as far as food and camp are concerned. Rescue work, particularly in radioactive areas, is back-breaking, dangerous work, requiring a high degree of skill and team training. To rely entirely on volunteers or to improvise at the time of emergency is to court disaster. The least acceptable standard, in view of past experiences, would call for full-time cadres of specialists to be augmented on the spot with trained volunteers for such services as rescue, medical, radiation detection, transportation, etc., and all others which are to be deployed immediately following the attack.

The manpower shortage favors the creation of mobile, full-time services. A British estimate places the size of the total rescue force necessary to deal with one atomic bomb exploding over an average British city at 200,000 men. While this estimate may be on the high side since it averages more than 10,000 individuals per square mile of damage, even half this amount gives a good idea of the civil defense priority on men to be fully trained, in readiness and exempt from draft to other war services. Mobile forces would considerably reduce the total size of the civil defense establishment necessary to meet any eventuality.

As the unit area of damage has grown to encompass a number of square miles, the problem of making local information available to the rescue force has become crucial. Exact information as to structural design and layout of buildings, water, gas, and electric layouts, large-scale maps showing location and capacity of shelters, hospitals, municipal facilities, and other such data must be prepared ahead of time. Their destruction during the attack or their mere absence at time of need has proved calamitous. Against atomic attack this information should be duplicated and stored on the outskirts of potential targets.

Post-raid operations in any one of the three typical phases involve tough decisions on priorities as to the order of operations and their purposes. Lives depend on these decisions, and there are conflicts between personal, local, and national interests. Again on the basis of the last war, it is clear that disasters of the magnitude of Hiroshima will call for the establishment of priorities by no lower a command echelon than state governors or their deputies with the full prestige and authority of the states and of the nation to back their decisions.

So far this brief review of civil defense experiences has dealt mostly with post-raid activities, justly so since they are more directly concerned with the primary function of civil defense. Yet a body of useful experience exists dealing with protective pre-raid measures such as shelters, fire and structural protection, and evacuation.

PRE-RAID MEASURES: PROVIDING PRACTICAL SHELTERS AND PROTECTION AGAINST FIRE

It is impossible for economic and practical reasons to provide shelters 100 per cent proof against blast, earth shock, and radioactive effects and housing the entire population even of the most vulnerable areas. The remedy is worse than the ill. During the war the belligerents adopted a standard design of protection definitely short of the bomb-proof level. In Britain the Anderson and the masonry reinforced street shelters were able to withstand blast, earth shock, and fragmentation at fairly close range, but not direct hits. The Germans relied on reinforced basements and cellars, also vulnerable to direct hits. Many casualties occurred in Germany among people trapped in these shelters by the large fires of the incendiary attacks. British and German shelter policy differed in so far as the Germans made sheltering an obligation whereas the British adopted a laissez-faire attitude. In both countries, experience proves that if shelters are to be provided at all, they must house a very high proportion of the population. Very deep shelters must be compartmented to minimize the risk of a calamity and must have sufficiently large and ramped access to allow prompt entry.

Following the same principles and policies which proved satisfactory during the last war, a minimum standard of protection should be established to withstand the effects at say one-half

mile from ground center of explosion of an atomic bomb exploding at 2,000 feet in the air. This would mean that a large proportion of the population within the half-mile radius would unavoidably become casualties. Tentatively, narrow, reinforced concrete structures, circular or rectangular in section, with sides and roofs at least twelve inches thick and partially set in the ground would meet these minimum standards; so would deep trenches laid out in zig-zag fashion and with tamped earth covers.

Fire protection measures have two aims, to prevent the start of fires and to impede the spread of fire. Broadly speaking, the first is met by reducing the amount of combustible materials to a minimum and the second by compartmenting the area at risk with a number of fire divisions, within and without, of manageable proportions. Details of these measures are outside the scope of this study, the significant point being that wherever these measures were vigorously undertaken, minimum fire damage resulted. The flash of intense heat radiation typical of atomic explosion and propagated in straight lines from the point of explosion complicates the problem and intensifies the need for fire protection. In the area immediately below the explosion the temperature is high enough to fuse stone, but it is also accompanied by blast which will collapse all buildings. In this area unless no combustible material is present, which is unlikely, fires will be lighted. Outside of this area fires are less likely to get started and spread if proper measures have been taken. The critical limit lies where blast will not destroy non-combustible shields against fire flash nor open up the confining walls of fire divisions. Since fire proved to be a very efficient agent of damage whose power of destruction lasts considerably longer than the attack itself, it is of vital importance to take the most stringent measures of fire protection in order to confine fires from the atomic fire flash within the so-called critical area.

Structural protective measures are designed to increase resistance to blast and near misses but not to direct hits. Blocking of openings with masonry screens, reinforcement of connections of beams to columns, and installation of props to withstand the weight of debris from upper floors, were successful in minimizing collapse and casualties. The same measures may be devised also to reduce gamma-ray effects. Structural protective measures are not improvised at the last minute; they are costly and require considerable labor.

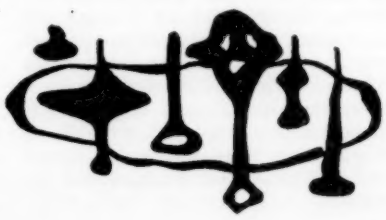
In the area of protective measures, experience again demonstrates the importance of careful coordination and planning, for there is no sense in carrying one phase of the program at the expense of another. A minimum standard of protection against *all* effects of the atomic bomb should be carried out in all phases of protective measures—partial measures are worse than none. The German experience must be avoided, where people in blast-proof shelters were trapped and either roasted or asphyxiated or drowned. The operation of a reasonable and minimum standard of protection, carefully thought out, is not beyond this country's resources, particularly if carried out only in the more vulnerable spots.

PROBLEMS POSED BY EVACUATION

Evacuation is not in itself a panacea, and in its extreme forms it results in serious social disturbances and complete dislocation of production schedules. There is no doubt that the removal of a substantial number of surplus civilians not essential to the war effort from exposed target areas to the relative safety of small communities is quite desirable. This type of voluntary migration was quite in evidence during the last war, but only the middle and higher income groups could afford it. There was little compulsory evacuation either upon declaration of war or during more active pre-raid periods. Experience on this type of operation is, therefore, on the thin side; yet the concept of mass evacuation which seems to be envisaged by some American planners is in direct opposition to European civil defense practices rooted in the effort to build up civilian courage and ability to "take it," and in the realization that war production and effort takes precedence over the risk of civilian casualties. Post-raid evacuation is, of course, a necessity, and part of the general procedure of rehabilitation. It is limited to the ill and the dispossessed. Once the excitement of the attack is past, nothing affects the morale of the survivors more directly than the efficiency of the evacuation services including food, shelters, and information services. From a long-range point of view, resettlement should be as near to the disaster site as is reasonably possible. There is a strong homing instinct among all evacuees which should be taken into consideration and encouraged.

Little has been said about civil defense services, their organization, and their equipment. Nagasaki and Hiroshima rather definitely proved that the radioactive aspect of atomic attacks alters the composition and procedure of the services concerned with the saving and rescue of lives, fire fighting, and repairs of utilities, that is, those who must work quickly within the radioactive areas. Civil defense against high explosive and incendiary damage was not long on equipment. Atomic attacks require a higher mechanical level to minimize the risks and facilitate operations, thus emphasizing and accelerating the trend toward highly trained full-time services and away from volunteers. This tendency is not without its drawbacks for undoubtedly the ability of civilians to stand well under fire was much enhanced by the participation in civil defense of large segments of the population. To reduce this participation will affect civilian morale and courage, but no one can tell how little or how much.

It would be unfair to close this article without mentioning that one of the most encouraging aspects of U.S. civil defense at the present moment is in the choice of its top command whose past experiences provide them with thorough and personal knowledge of air force and atomic development. They are thus well able to weigh the risks involved in the present situation and to draw on past civil defense experiences to plan efficiently.



PSYCHOLOGICAL PROBLEMS OF A-BOMB DEFENSE

Irving L. Janis

The following article consists of excerpts from a report prepared for the RAND Corporation, Santa Monica, California, to which the author is a consultant. The report was designed to call attention to psychological problems arising from A-bomb attacks, which require intensive research. The material will be part of a more detailed discussion in the author's forthcoming book on the psychological impact of wartime disasters. Dr. Janis is a member of the Department of Psychology at Yale University.

SUDDEN awareness of immediate danger appears to have been the initial experience of almost all survivors of the atomic disasters at Hiroshima and Nagasaki. In the accounts given by those who lived through it, the atomic attack is described primarily as a personal catastrophe—a completely unexpected event during which there was a sharp realization of the threat of imminent annihilation.

Over one hundred of the survivors were interviewed several months after the atomic disasters by the Morale Division of the United States Strategic Bombing Survey (USSBS). The vast majority described exposure to extreme conditions of danger, especially the severe blast effects. Some spoke about the painful lacerations they suffered from missiles of flying glass. Others vaguely remembered having been knocked unconscious after being hurled through the air and then, in a semi-dazed and helpless condition, facing the harrowing dangers of a raging conflagration. A few alluded to themselves as being the sole survivors of a shattering blast that killed everyone else in the same room.

One of the obvious consequences of a "narrow escape" is extreme emotional excitement accompanied by temporarily impaired ego functioning. All available sources of information consistently indicate that acute anxiety was a dominant reaction to the atomic explosions. From statements made by survivors one is able to gain some inkling of the intensity of the emotional impact. The following spontaneous comments illustrate fairly severe terror states:

I became hysterical seeing my grandmother bleeding and we just ran around without knowing what to do. . . . After that atomic bomb I was constantly afraid.

(Domestic worker in Nagasaki)

After recovering from the concussion I got up and ran to the mountains where the good shelter was. I just ran like crazy. I stayed in the shelter for three days. . . .

(Office worker in Nagasaki)

My children were injured and I was in such emotional upset that I couldn't think straight.

(Factory worker in Hiroshima)

There are no words that can describe the terror it caused . . . . After our house was destroyed I took my children and fled to the woods. We were so scared that another would fall that we stayed in the woods for two days wondering what to do next.

(Housewife in Nagasaki)

Only a few respondents volunteered information of this kind. But it appears that at least in a small percentage of cases the emotional excitement reached such a level that there was temporary loss of inhibitory control over primitive, automatic manifestations of acute anxiety.

In other cases the acute emotional disturbance took the form of profound apathy and depression. John Hersey refers to several such cases in his report on Hiroshima. He describes one extreme case in detail: A fifty-year-old man, uninjured by the explosion, stood weeping at the window of a burning building. When an attempt was made to rescue him, his only response was "Leave me here to die." After being forcibly carried to safety he managed to break away and ran back into the fire.

Instances of less severe depressive reactions are to be found among the respondents in the USSBS survey. A Nagasaki housewife, for example, spoke about manifestly suicidal feelings:

I carried my son on my back and we rushed toward the hills. It was very cold and the rain started to fall. At that time I wished we had died in the explosion of the bomb.

A few other respondents verbalized similar depressive tendencies which, from the context, do not appear to be mere expressions of conventional Japanese attitudes concerning the appropriateness of suicide.

In general, the quality and intensity of acute symptoms of anxiety and depression among the A-bombed survivors do not appear to differ in any unique way from those observed among the British and Germans who were subjected to exceptionally severe air attacks. As has been described in a separate report on civilian reactions to air raids during World War II, chronic psychopathological reactions (such as "traumatic neurosis") occurred very rarely as a result of bombing. Nevertheless, temporary emotional reactions to shock were quite frequent among those who barely escaped from immediate danger. From clinical observations in the European war, it appears that such experiences have the effect of temporarily shattering the individual's psychological defenses—defenses which had formerly prevented the outbreak of anxiety in the face of environmental threats by maintaining feelings of personal invulnerability. That the same psychodynamic processes were evoked by the overwhelming terror at Hiroshima and Nagasaki is suggested by

certain of the interviews which indicate that intense emotional reactions were linked with subjective awareness of personal vulnerability. . . .

. . . On the basis of the available evidence on the conditions under which emotional shock occurs, it is possible to specify the types of events created by an atomic explosion that are likely to evoke acute symptoms. The most severe forms of emotional shock are to be expected among survivors who undergo experiences of the following sort:

a) being knocked down, violently shaken, buried beneath debris, or experiencing similar direct exposure to blast effects;

b) being injured by fire or by blast effects;

c) narrowly escaping from burning buildings;

d) witnessing the death of a member of the immediate family.

If the population of a target city is unprotected, the vast majority will probably undergo traumatic experiences of this kind in the event of an atom bomb attack. It should be recognized, therefore, that the adequacy of civil defense preparations designed to increase the physical safety of the population have a direct bearing on the emotional impact of an atomic disaster. If a target city cannot be warned and evacuated before an attack is launched and if the residents cannot reach adequate shelters, the devastating consequences cannot be counted solely in terms of the inordinate toll of dead and severely injured people. The less adequate the protection of the population from the physical impact of an atomic disaster, the higher the incidence of emotional shock and disorganized behavior. Such reactions, on a mass scale, would give rise to extremely critical problems of disaster control.

MALADAPTIVE BEHAVIOR

In the event of an atomic disaster, even those survivors who are not casualties from emotional shock will be in an extremely aroused emotional state. The mere sight of the vast devastation and the hideous sights of the dead and dying will produce a terrifying effect upon almost everyone in the area of disaster. Those who escape any direct experience of the explosion in and around the target will be extremely disturbed not only by the appalling sights about them, but also by the intense suspense of not knowing the fate of their families and close friends. Many persons might also be extremely apprehensive about the possibility that they may have been exposed to lethal amounts of radiation. Such sources of emotional stress greatly increase the likelihood of excited, impulsive, and maladaptive behavior.

Under the disorganizing influence of acute anxiety, many uninjured survivors might fail to give essential aid to others who are in dire need of their help. There may be a widespread tendency to neglect the precautions necessary for avoiding exposure to contaminated supplies and lingering radioactivity. In attempting to escape from the raging fires, large crowds might congregate in areas which offer far less protection than other places of refuge which are just as accessible. In Hiroshima, according to Hersey, hundreds of people sought refuge in a park near a river, and, as the fire pressed closer, the crowd began to push toward the river. Those who were on the bank were forced into the water and many were drowned.

How can inappropriate, disorganized, and maladaptive responses be prevented? To some extent the prior training of the general population will be useful in preparing people to act intelligently in a disaster. (As is indicated in another section of the report, one of the major needs for adequate civilian defense preparation is a mass educational program that would reach the entire population of all potential target areas in the United States. The essential purpose would be to teach the most elementary knowledge necessary for appropriate behavior in an atomic disaster—with emphasis upon realistic information about *what the dangers are* and a corresponding set of *do's and don'ts*.) But such information is often forgotten at the very time when it is needed most, if people are highly aroused emotionally. Some special psychological devices are necessary to reduce emotional excitement promptly, to the point where people will make use of the preparation they have been given.

Perhaps the most effective device would be a calm, familiar, authoritative voice giving both reassurance and directions as to what should be done. Such a device might be readily available if there were an intact public address system in every major target area. An underground communication system might be installed which would be designed to withstand the damage from an atomic bomb explosion. Radio broadcasting units mounted on trucks might prove to be ineffectual because they could not reach the disaster area early enough to prevent confusion; mobile broadcasting units mounted on airplanes, on the other hand, might be a highly effective adjunct to the local broadcasting system and might even be a satisfactory substitute for it.

In any case, each potential disaster area probably could benefit considerably from having a public address system which could be put into operation immediately after an explosion. It could be a tremendous asset in a variety of ways. The survivors in each neighborhood could be given prompt instructions (based on information from air and ground observers) about appropriate actions to take. They could be told when to remain in their homes, when to evacuate, and where to go. They could be reminded of the precautions they had already been trained to take. In neighborhoods where there is little danger present, they could be urged to aid in rescue work and in other forms of disaster relief. But, above all, the calm, authoritative voice of a familiar radio announcer might be extremely effective in reducing confusion and emotional excitement, particularly if reassuring announcements are given about the arrival of rescue and relief teams.

There is probably very little danger that a metropolitan public address system of the kind suggested could be exploited by the enemy for purposes of psychological warfare. Appropriate code methods for putting the system into operation could easily limit its operation to designated civil defense officials who would be scattered among various communities in the defense region.

If engineering research solves the problem of devising a public broadcasting system that will remain fairly intact following an atomic bomb explosion, and if such a system becomes an integral part of the U.S. civil defense program, it will be worth while to investigate various means for insuring its maximum effectiveness. For example, it would probably be useful to give the metropolitan population some prior experience with it. The loudness, tonal quality, and location of the sound source should be familiar so that it will be readily recognizable in an emergency. If there are practice air raid alerts, it might be useful to employ the public broadcast system to announce the all-clear signal so that the radio voice will be expected following an air attack and will be associated with the emotional relief that accompanies termination of the threat. . . .

EMOTIONAL RESPONSES OF RELIEF WORKERS

One of the major goals of civil defense operations will be to give prompt aid to thousands of survivors within the A-bombed area. It will be necessary for medical first-aid units and many other types of civil defense teams to enter the disaster area as soon as it is reasonably safe to do so. The number of lives lost may be drastically increased if rescue workers are unable to carry out their assignments efficiently. Consequently, it is important to take account of emotional reactions which may seriously interfere with the performance of esssential rescue and relief operations.

The tremendous devastation in the disaster area is likely to be a disturbing factor. Even more disturbing will be the sight of people who have been mutilated by the explosion. The US-SBS report on the effects of the atom bomb on Hiroshima and Nagasaki asserts that many uninjured survivors were horrified and shocked by the sights about them....

Many people when confronted by the appalling casualties may react so emotionally that they are unable to perform their assignments. Some special form of preparation—some kind of emotional inoculation—is necessary for the average civilian who is being trained to carry out an assignment in a disaster. Some of the devices which have been used on a limited scale in the psychological preparation of soldiers for combat—such as realistic sound films—may prove to be effective for this purpose, but a good deal of research will be needed in order to be sure that they do not do more harm than good.

It has been suggested that the device of using increasing doses of graphic sound films (preferably in technicolor) showing actual disasters should be investigated as a possible way of hardening people and preventing demoralization. This might also prove to be a useful screening method for eliminating from key positions those persons who become inordinately upset when exposed to disturbing stimuli.

The problem of the emotional reactions of medical aid personnel is an especially acute one, since there will probably be thousands of casualties whose life or death may depend upon the promptness and efficiency of the medical treatment they receive. John Hersey gives a graphic account of the experiences and behavior of a few survivors who set about the task of using their skills to aid the injured.

. . . bewildered by the numbers (inside the hospital), staggered by so much raw flesh, Dr. Sasaki lost all sense of profession and stopped working as a skillful surgeon and a sympathetic man; he became an automaton, mechanically wiping, daubing, winding, wiping, daubing, winding.

Near the entrance to the park, an Army doctor was working, but the only medicine he had was iodine, which he painted over cuts, bruises, slimy burns, everything—and by now everything that he painted had pus on it.

To avoid distraught and inept performances among civil defense workers, especially in rescue and medical aid units, it will be necessary to give them an opportunity to develop some degree of emotional adaptation to the job of handling large numbers of mutilated human beings. Perhaps the most useful method would be to introduce them gradually to the experience of working with patients in medical clinics and hospitals, ending, if possible, in the emergency room of a large metropolitan hospital. This type of participation in actual medical aid work has been suggested elsewhere in this report for other reasons as well.

Another type of problem which will confront many civil defense workers arises from the fact that they will be dealing with disaster victims who are in an extremely anxious or disturbed state. Quite aside from the cases of emotional shock who will require special psychiatric treatment, there may be large numbers of victims who will be in a severely apprehensive state about the realistic possibility that within a week or two they may die from radiation sickness. There will also be large numbers of persons, both among the sick and the well, who have been unable to locate members of their families. Knowing that there are huge numbers of unidentified dead and injured, they will be in an extremely agitated state. In addition to apprehensiveness about radiation sickness and anxious concern about missing loved ones, there will be other sources of emotional disturbance as well: bereavement, anxiety about disfigurement, jitteriness about the danger of another A-bomb attack.

There is a twofold problem h e r e. First, the disaster victims will require calm, reassuring, patient handling during the days and weeks following the attack. Second, the civil defense workers who come in close contact with disaster victims must be able to withstand the emotional strain and demoralizing influence of working with large numbers of persons who are in an extremely anxious or depressed state of mind.

Such problems require careful consideration in planning the organization of medical and social services. For example, in setting up a system of sorting medical casualties so as to give priority to those who have the best chance of recovering, it may be desirable to arrange for segregating those radiation victims who are doomed to die, so that they will not have a demoralizing effect on a large number of medical aid personnel and on other patients. For the large number of patients who will be worried about epilation, ugly scar tissue, and other disfigurements, a special series of pamphlets and posters might be prepared in advance, containing reassuring information about treatment and the chances of recovery. These printed materials could be included in emergency supply kits and distributed at the appropriate time in disaster aid centers.

This problem should also be considered in the training of civil defense personnel. All those who are likely to deal with emotionally upset disaster victims might be given some instruction and practice in elementary psychotherapeutic principles. To the extent that defense workers are able to give appropriate help to disaster victims, the unfavorable effects of widespread emotional upset will be reduced within their own ranks as well as among the people they are trying to help....

PSYCHIATRIC CASUALTIES

The vast majority of cases suffering from acute anxiety and other symptoms of emotional shock will probably recover spontaneously shortly after the danger has subsided.

Nevertheless, there will probably be a sizeable minority who will not recover promptly from the harrowing, traumatic experiences of the disaster. Such persons will not be capable of productive work and will have a demoralizing effect upon others in the community. There is little likelihood that skilled psychiatric aid will be available for all of the temporarily maladjusted persons, but it may be possible to speed recovery by adopting sound policies of rehabilitation. This is a special problem which calls for planning in advance. For example, it might be possible to set up temporary rest camps in which a therapeutic atmosphere is maintained so that those who are too disturbed to return to productive activity will have an opportunity to recuperate. . . .

At present there are insufficient numbers of trained psychiatrists, psychotherapists, and psychiatric social work-

ers to meet the current needs of the U.S. population. In fact, this is one of the most critical shortages of skilled personnel we face. As the armed forces are expanded, more and more psychiatrists will be drained from the civilian supply, making the shortage all the more acute. Obviously one of the essential needs of civil defense preparation is to increase greatly the number of skilled personnel capable of handling the emotional shock casualties to be expected in case of A-bomb disasters. . . .

. . . Even with a greatly expanded professional training program, it will be necessary to have large numbers of nonprofessional civil defense workers trained in elementary psychotherapeutic techniques if cases of emotional shock are to be given the barest minimum of treatment. Considerable research effort is needed in order to develop effective psychiatric first-aid techniques and rapid therapy methods for handling large numbers of traumatized survivors.

It is possible that some special techniques of emotional innoculation will be discovered which might prove to be effective in reducing the incidence of emotional shock casualties among survivors of a disaster. It is unlikely, however, that any such devices will eliminate the need for psychiatric first-aid techniques. Nevertheless, there are marked individual differences with respect to ability to withstand traumatic events which could be taken into account. It should be feasible to improve methods of detecting the most vulnerable and the least vulnerable personalities for such purposes as selecting leaders and making evacuation plans.

GENERAL EFFECTS ON MORALE OF A-BOMB ATTACK

In general, a single atomic bomb disaster is not likely to produce any different kind of effects on morale than those produced by other types of heavy air attacks. This is the conclusion reached by USSBS investigators in Japan. Only about one-fourth of the survivors of Hiroshima and Nagasaki asserted that they had felt that victory was impossible because of the atomic bombing. The amount of defeatism was not greater than that in other Japanese cities. In fact, when the people of Hiroshima and Nagasaki were compared with those in all other cities in Japan, the morale of the former was found to resemble that of people in the lightly bombed and unbombed cities rather than in the heavily bombed cities. This has been explained as being due to the fact that morale was initially higher than average in the two cities because, prior to the A-bomb disasters, the populace had not been exposed to a series of heavy air attacks. Apparently a single A-bomb attack produced no greater drop in morale among the Japanese civilians than would be expected from a single saturation raid of incendiaries or of high explosive bombs.

An inordinately high degree of apathy was noted among the survivors in the A-bombed cities. The Medical Division of USSBS visited Hiroshima three months after the bombing and observed that the city had still not recovered to the point where adequate shelter and essential utilities were available: Only a few shacks had been constructed for homeless people; there was no garbage or sewage collection, etc. It is not likely, however, that the lack of organization and the absence of initiative found in Hiroshima was a unique effect of the A-bomb attack. Similar apathetic attitudes have been observed throughout Japan as a consequence of multiple sources of demoralization during the period immediately following the unexpected surrender.

It seems highly probable that the same factors found to be responsible for lowering morale among civilians exposed to the "traditional" type of air raids will be operative in the case of an A-bomb attack. Accordingly, a major source of information for predicting the effects of A-bombs on morale is the set of conclusions reached on the basis of studies of civilian reactions to air raids during World War II. . . .

POTENTIAL SOURCES OF DEMORALIZATION

To a very large extent, the morale of the survivors of an atomic bomb attack will be determined by the effectiveness of civil defense measures. If aid and relief measures are not well planned or if they cannot be put into operation—owing to multiple A-bomb attacks — an extremely unfavorable situation is to be expected. Following the emergency evacuation of a bombed city, homeless survivors would be widely scattered over a large region. There would be frantic competition for the scarce quantities of food, water, and medical supplies available. Many groups of survivors who received no help from people in outlying communities might become extremely hostile and attempt to obtain shelter and supplies by force if necessary. Thousands of half-starved people would be wandering about for a long period, seeking for their lost families or friends.

Obviously, if this type of social disorganization occurs following an atomic disaster, a prolonged period of demoralization is to be expected. On the other hand, if the essential needs of the survivors are well provided for, and if there is sound community leadership, there is every reason to expect that within a short period the vast majority will willingly participate in reconstruction work and make a fairly adequate adjustment to the deprivational situation. . . .

In planning the organization of a community to function efficiently following a major disaster, it will be useful to know which types of persons can be relied on and which types are most likely to be uncooperative and demoralized. Field studies of current peacetime disasters in the U.S. might provide a rich source of empirical material for predicting *who* will be an asset or a liability during the reconstruction phase.

If the survivors cannot be permitted to return to the target city for a prolonged period because of the presence of lingering radioactvity, there are likely to be serious problems of social reorganization which may have an unfavorable effect upon morale. Deprived of the opportunity to return to their own community and to engage in its reconstruction, survivors are likely to become deeply pessimistic about the future. To meet this contingency, special plans are required to provide for either prompt relocation of the community on a new site or the absorption of survivors into other existing communities.

MORALE IN UNBOMBED CITIES

The psychological effects of the bombs dropped on Hiroshima and Nagasaki were found by USSBS investigators to be much less marked in the rest of Japan than in the target areas. When the people in neighboring communities learned about the devastation produced by the bombs, their primary reaction was fear. But over the islands as a whole, the proportion who expressed a personal fear of being killed by an A-bomb was only half as great as that among persons who had been directly exposed to the bombing. The effect

of the A-bombs on other attitudes which compose morale was also much less marked in the country as a whole. It was found that attitudes of defeatism and unwillingness to go on with the war because of the A-bomb varied inversely with the distance from the target cities. Only in the cities within a 40-mile range was there a definite effect on morale.

From the standpoint of predicting responses to subsequent A-bomb attacks, the findings on Japanese reactions are of very limited value because:

a) The vast majority of the population was already suffering severe wartime hardships, and among a substantial proportion defeatist attitudes had already developed owing to military losses, the food shortage, and the concentrated incendiary and high explosive attacks on Japanese cities;

b) The A-bomb was given almost no publicity within Japan prior to the surrender, and its existence remained unknown to the vast majority of the population;

c) The surrender followed very soon after the A-bomb attacks, obscuring whatever effect the latter might subsequently have had. (The surrender itself, according to USSBS investigators, was not largely attributable to the A-bomb attacks: a powerful faction of the Japanese government was already prepared to surrender unconditionally, and the A-bomb appears to have hastened this action by providing an obvious "face-saving" excuse.)

"WILL THERE BE WIDESPREAD PANIC?"

Prior to World War II, government circles in Britain believed that if their cities were subjected to heavy air raids a high percentage of the bombed civilian population would break down mentally and become chronically neurotic. This belief, based on predictions made by various specialists, proved to be a myth. Already there are some indications that a similar myth is beginning to develop with respect to future A-bomb attacks: the belief that the news of the first A-bomb attacks in this country will produce panic among the residents of unbombed metropolitan centers and industrial areas.

There is, of course, a serious danger that people who expect their city to be the next target might behave in an excited, socially disruptive fashion. But, for purposes of civil defense planning, it is not very useful to assume that "panic" will necessarily be the most probable response.

First of all, "panic" is an extremely ambiguous term. The image it usually brings to mind is that of a wildly excited crowd behaving in an impulsive and completely disorganized fashion, each person abandoning all social values in a desperate effort to save himself. From the available literature on extreme fear reactions, it appears that this sort of behavior very rarely occurs unless (*a*) there is an obvious physical danger which is immediately present (e.g., a raging fire only a few feet away), and (*b*) there are no apparent routes of escape. Hence "panic," in the limited sense of the term, is likely to be evoked by an A-bomb attack primarily in the area where the disaster actually occurs (e.g., among those who are trapped by the general conflagration within the city). In places which are not directly affected by the explosion (e. g., in cities which are likely targets for the next attack), there is far less danger of a serious outbreak of overt panic. That is to say, there is a strong likelihood that with appropriate preparation such reactions may be prevented.

"Panic" is often used by both popular writers and social scientists as a colorful term to designate a wide variety of activities which are judged to be inappropriate to the situation....For purposes of analyzing and predicting social responses it is preferable to avoid using a term which connotes the sort of behavior that occurred in the Cocoanut Grove fire when referring to other less extreme sorts of action motivated by fear. In order to avoid ambiguity it is necessary to reformulate the question with which this discussion began; instead of asking, "Will there be widespread panic?" our inquiry should be centered upon: (*a*) What forms of overt behavior are likely to occur under various conditions of A-bomb attack? and (*b*) By what means can the more extreme forms of personal disorganization and inappropriate action be prevented? The discussion which follows will be limited to some of the more general considerations.

One of the major conditions under which extreme emotional reactions are likely to occur is a very sudden, unexpected confrontation of the threat. . . . In a sense, almost all of the points discussed in this report are tied up with the problem of providing adequate psychological preparation for the U. S. public so as to prevent the occurrence of excited, disorganized, and maladaptive behavior. To the extent that the public is informed about ways and means of coping with the dangers and trained to participate in civil defense operations, disruptive fear reactions will be minimized. The educational program for the general public—as well as the other features of an adequate defense program to be discussed later—should have the effect of building up realistic expectations and of counteracting feelings of helplessness when the danger becomes imminent.

It cannot be assumed, however, that a successful program of preparation will eliminate subjective feelings of fear. No matter how well they are prepared, the residents of all potential target areas will become extremely apprehensive as soon as they learn that the first A-bomb attack has occurred in this country. The preparation they have been given, however, should serve to *channelize* their overt reactions: If the population does not feel utterly helpless, and if emergency measures have been well planned and organized in advance, there will probably be a high degree of conformity to the regulations issued by civil defense authorities. . . .

UNAUTHORIZED EVACUATION

Obviously, there will be a strong urge to get away from threatened target areas. This will be an asset or a liability from the government's point of view, depending upon whether or not its defense plan calls for prompt evacuation of metropolitan targets. A number of social scientists have strongly recommended that if mass dispersal is not carried out in advance, the government should make plans to minimize casualties by evacuating the population of metropolitan areas rapidly, as soon as the first atomic bomb attack is launched against the United States. If this policy is adopted by the government, and if plans have been worked out for orderly and controlled migration to dispersed assembly centers, there is likely to be a fairly high degree of conformity to the evacuation plan. The strong drive to leave the target area will motivate the population to respond to official evacuation orders. While there is always a possibility of spontaneous, disorganized flight or of disruptive competition to reach the most advantageously located safety zones first, such tendencies can be minimized by preparing the public in advance. Such preparation might include:

1. Informing the residents of each city about the local evacuation plan, and perhaps also assigning most adult members of the community to a "battle station" in specified evacuation localities where it is one's "duty" to be present;

2. Emphasizing the benefits (for oneself, one's family, and the entire community) to be derived from strict conformity to the local evacuation plan, along with emphasis on the theme that nonconformity is socially irresponsible behavior;

3. Notifying the public of special sanctions to be applied against nonconformists in the event of an evacuation crisis.

If the government's defense plan requires residents of an obvious target area to remain there, considerable public resistance is to be expected immediately following the first A-bomb attack. The degree to which there is spontaneous, unauthorized evacuation from cities and reduced productive efficiency among essential industrial workers will depend upon a variety of factors. Obviously, one of the most important factors will be the amount of public confidence in the civil defense organization. . . .

. . . If the initial attack occurs without any warning before war has been declared, the spontaneous tendency of the majority of the population in unbombed metropolitan areas will be to evacuate the city immediately, whether that action is authorized or not. The most critical factor in preventing this form of action—short of a convincing official announcement to the effect that no further attacks are possible—will be the availability of adequate shelters. If the shelters are regarded as inadequate, a sizeable proportion of the urban population may be expected to pack up and leave unless they are prevented from doing so by coercive force—in which case there is likely to be considerable resentment as well as a marked deterioration in job performances. Hence, in avoiding widespread confusion and non-conformity to official demands during the period immediately following the initial A-bomb attack, the key problems are: (*a*) to develop a feasible plan for an organized emergency evacuation of those who will not be needed in the target area; and (*b*) to supply adequate shelters for those who will be required to remain.

Emergency evacuation on a mass scale will be a considerable undertaking requiring detailed plans not only for the orderly migration from threatened areas but also for the social organization of the evacuation centers. If large numbers of people are to remain in evacuation centers for a prolonged period, many social and psychological problems may be expected to arise. In this connection, social science research should be directed toward obtaining essential information for the planning of sound evacuation policies.

POPULATION DISPERSAL

A number of writers have urged that the entire urban population of the United States be widely dispersed so as to reduce the effectiveness of atomic bomb attacks. For example, Edward Teller, in an article in the *Bulletin of the Atomic Scientists*,[1] claims that the enormous effort involved in large-scale dispersal would be rewarded by a high degree of safety: "Then a few thousand Hiroshima bombs could kill only one per cent of our population." Although many scientists agree that in all likelihood we shall be attacked by large numbers of atomic bombs if there is another war, very few share the optimistic expectation of achieving such a high degree of safety by means of mass dispersal. Moreover, it has been pointed out that a dispersed population would be just as vulnerable to bacteriological warfare as people in cities, if not more so; this might also hold true for radiation poisons and other unconventional weapons as well.

From the many estimates which have appeared on the staggering economic costs involved, the length of time this dispersal would take, and the tremendous social and political consequences it would entail, it appears to be highly improbable that a mass dispersal program will be adopted in this country. Nevertheless, some limited degree of dispersal is to be expected. According to some reports, relocation of industrial plants has already begun on a very small scale; it is likely that decentralization of industry will be increasingly encouraged, if not demanded, by the government. In numerous articles attention has been called to the vulnerability of centralized administrative agencies of the government, and it is not improbable that these, also, will be subject to dispersal. Consequently, it appears safe to assume that at least a small segment of the U.S. population will be affected by a limited dispersal program.

So long as the dispersal program is kept down to a small scale, little resistance is likely to occur. But if large-scale industrial units are removed from areas in which they employ a large percentage of the resident population, considerable protest and resistance is to be expected.

Such resistance may be overcome by offering attractive inducements to those affected, to encourage and facilitate their moving along with the industrial organization that has been employing them. But, if the problem occurs on a sufficiently wide scale, it is likely that a major psychological problem of national scope may arise.

One of the obvious ways of attempting to convince dissident industrial workers that they should accept relocation is to arouse their anxiety. Strong emphasis upon the dangers of atomic bomb attacks and on the avoidance of this danger by taking advantage of the opportunity to move to a less vulnerable section of the country may appear to be a successful way to overcome resistance to dispersal. But it may also be effective among broad sections of the population for whom no relocation plans are intended. Instead of the problem of resistance to the limited dispersal program, the government may be faced with public clamor for far more extensive dispersal plans; at the same time there may be a considerable amount of spontaneous, unplanned relocation. The possibility of such boomerang effects calls attention once again to the need for public opinion and attitude research on the predispositional tendencies of the American population, in order to gauge the probable impact of alternative policies in communication.

THE PROBLEM OF SHELTERS

It is likely that an important feature of the national defense program will be a priority system in the construction of shelters, underground installations, and other protective sites. If a large proportion of the available manpower and raw materials of the country are devoted to building up offensive weapons and well-protected retaliatory installations, the construction of shelters in urban areas will undoubtedly be limited to the barest essentials. Underground shelters and installations may be constructed for key industrial and administrative personnel; for critical supplies; for irreplaceable libraries of blueprints, maps, industrial, and military data. Some provisions may also be made for workers in essential industries. But it is highly unlikely that there will be sufficient manpower to construct adequate shelters for the majority of the population, even in the most vulnerable urban centers.

Noting the ever increasing signs of hectic preparation, seeing and some-

[1] *Bulletin*, III (February 1947), 35.

times participating in the construction of shelters for others, urban residents are likely to become increasingly alarmed by the fact that no attempt is being made to provide them with protection from direct exposure to an atomic bomb attack. If the potential danger of such attack becomes more and more apparent, the demands for public shelters may become a critical political issue.

This anticipated social problem might be easily solved by a single technological advance. An effective, inexpensive, radioactive-absorbent material is needed which would reduce the costliness of the construction now required when earth, concrete, or lead is used. If a new substance were invented which could be readily manufactured in mass quantities from raw materials in plentiful supply, it might be possible to furnish a large proportion of the urban population with prefabricated shelters. . . .

If physical scientists are able to solve the technological problem of providing the American people with the materials for constructing adequate physical protection against A-bomb explosions, many of the social and psychological problems to be discussed in the remainder of this section and in some of the other portions of this report will be eliminated.

Assuming that the only substances available are concrete, earth, and bricks, the critical factor preventing construction of adequate public shelters will most probably be the manpower shortage. If this should prove to be the case, there is a partial solution to the problem which may prove to be both feasible and psychologically sound: the policy of encouraging people to build their own shelters. If the public is told how to build private shelters, and if there is high anxiety about the danger of an atomic bomb attack, it is probable that a fairly large proportion of the urban population would contribute their spare time to providing this measure of security for themselves and their families.

From the available information, it would appear that there is nothing unusually complicated about the construction of home shelters of a type which would give a fair degree of protection in an atomic bomb attack. According to some experts, it would be difficult to build a shelter that gives close to 100 per cent protection because it would have to be blast-proof and airtight, with an oxygen supply that would last for many hours or even days without becoming contaminated by radioactive particles from the outside. But in an atomic disaster tens of thousands of lives might be saved even by shelters which are only partially effective.

Front-line combat troops are encouraged to dig foxholes even though this form of shelter offers no protection against a direct hit. If the urban populations are exposed to the threat of an atomic bomb attack, they will probably feel that they are in comparable danger, and they could be encouraged to provide themselves with something equivalent to a foxhole if nothing better can be provided. For example, by lining the walls of the basement of a private dwelling or of an apartment house with concrete or bricks, one can make a fairly adequate shelter. If entered before the detonation occurs, it might provide excellent protection against heat blasts and flying glass, and—depending upon the distance from the explosion—some degree of protection against gamma rays.

The problem of what *kind* of shelters people could build for themselves is one that should be tackled by practical engineering technicians, who would take into account the nature of the materials that are most likely to be available. A set of specifications could be drawn up ranging from complicated structures that are highly protective to simple ones which provide a slight amount of protection. These specifications could be made available to the public, together with full details about how to carry out each step, where to get the materials, and so on.

Additional information on the possible uses of caves and other special features of the terrain might be provided for those who live in towns near mountains or hills. Details could also be given on the probable amount of time there will be between a warning signal and the atomic bomb explosion, along with some advice about how close the shelters should be to one's own home. In some neighborhoods, for example, the residents might wish to build community shelters if they could expect to have sufficient time to get to them . . . .

If specifications for various kinds of homemade shelters are drawn up, the information could be incorporated into the public education program. The government might be able to give additional encouragement to the homemade shelter program by providing certain types of available materials free or at a nominal cost and by setting up in each community (perhaps as one part of the civil defense organization) a board of local construction experts who would be able to give advice to those in need of it and to inspect homemade shelters for the purpose of suggesting simple ways of improving them.

One of the major drawbacks of such a program is that it may arouse acute social resentments among those classes of the population which are not in a position to acquire or build adequate private shelters. To prevent disruptive social antagonisms from arising it would probably be necessary to resort to careful rationing procedures of available materials and to provide some form of government subsidy to equalize the opportunity for constructing shelters among all economic classes.

If the problem of class differences in safety can be solved, the homemade shelter program might be extremely successful at a time when there are strong feelings of insecurity about impending atomic bomb attacks. First of all, participation in this form of self-protective activity would contribute to the feeling that "I am really able to do something about it." When danger is anticipated, feelings of anxiety are most intense if a person feels that he is helpless, that he is unable to do anything to ward off the impending danger. Such feelings are counteracted by engaging in constructive activity. Second, if personal responsibility for providing one's own shelter is accepted, there is less of a tendency to place full reliance for one's protection upon the authority figures of the government. Consequently, there would be less likelihood of reacting to apparent "neglect" on the part of the government with anxiety and resentment. Third, after the homemade shelters are constructed, they may become an important source of reassurance. Awareness of their real protective value as well as non-rational factors (e.g., "I made it myself") may invest them with considerable symbolic value as an anxiety-reducing feature of the environment. Hence, even though surprise attacks may preclude the usefulness of shelters for some people, they will, nevertheless, be psychologically advantageous. So long as people do not expect all atomic bomb attacks to be surprise attacks, homemade shelters may be expected to serve this function. And, if our population is ever exposed to atomic bomb attacks which are not surprise attacks, the feelings of security provided by the shelters will prove to have been highly realistic.

THE TREATMENT OF IRRADIATION SICKNESS

J. Garrott Allen, M.D., Peter V. Moulder, M.D., and Daniel M. Enerson, M.D.

The following article summarizes the results of a six-year study of the effects of irradiation conducted by a group of doctors, headed by Dr. J. Garrott Allen, in the Department of Surgery at the University of Chicago. Dogs were used in the experimental testing, since irradition injury in dogs is similar to that in humans. The treatment of burns and other injuries secondary to irradiation is not included in this discussion, but cannot be disregarded in the over-all picture.

ATOMIC warfare abruptly confronted physicians with the problem of treating a new disease—irradiation sickness. Many casualties at Hiroshima and Nagasaki resulted from burns and mechanical injuries, but the seriousness of these injuries in the closer ranges (0.8 - 1.5 miles) was greatly magnified because victims were also exposed to ionizing irradiation from the bomb. Treatment, therefore, must take into account both the immediate local injury and the delayed, insidious generalized damage known as irradiation sickness.

IRRADIATION SICKNESS

Irradiation sickness is characterized by immediate but temporary nausea and vomiting. This is followed by a period of six to ten days of comparative well-being which, in turn, ends abruptly with the onset of weakness, loss of appetite, vomiting, diarrhea, bleeding, and fever. Death follows fatal exposure by between one and six weeks. Four primary physiologic disorders account for most of the symptoms and deaths from irradiation. These are infection, bleeding, anemia, and malnutrition. These disturbances, although interrelated, require separate consideration in planning a program of medical treatment.

Anemia.—A severe anemia always develops after heavy exposure to total body irradiation. This anemia appears during the first week and progresses rapidly. By the third week less than 40 per cent of the normal amount of the red blood cells may remain in circulation. During the recovery period, anemia may still be present as much as two to three months after exposure.

The early onset of anemia is caused by an increased rate of destruction of the red blood cells. The blood lost from spontaneous bleeding caused by irradiation contributes to this anemia but occurs slightly later. Finally, in the recovery phase, the bone marrow which has been severely damaged by irradiation is not able to produce red blood cells at its normal rate, thus prolonging anemia. Although profound, this bone marrow injury is not permanent. Total recovery will occur if the victim of irradiation can be safely carried through the first eight weeks.

Liver and iron therapy which is effective in treatment of other types of anemia is much less effective in treatment of irradiation anemia until the bone marrow recovers from its damage and can again produce red cells. Therefore, red cells must be supplied at frequent intervals by whole blood transfusions. The average individual receiving a near-lethal dose of irradiation would require at least one pint of blood every other day beginning the third or fourth day after irradiation. This does not take into account the considerable additional amounts of blood required to replace that lost from burns, lacerations, fractures, and other wounds. This treatment will be necessary for from four to six weeks in order to maintain a satisfactory red cell count. Thereafter, iron, liver, and certain vitamins may be useful and should be given as supplements.

The anemia of irradiation becomes so profound that it increases the oxygen needs of the individual; therefore, oxygen therapy may be required by the patient during the critical stages of irradiation sickness. Patients at high altitudes should, for this reason, be evacuated to sea level if possible.

Bleeding.—Spontaneous bleeding is a prominent feature always present but variable in severity in the lethal or near-lethal irradiation exposures. Although bleeding in the skin and internal organs is a conspicuous result of irradiation, it is probably not the most frequent cause of death.

At least three important disturbances contribute in varying degrees to the hemorrhage that occurs after irradiation: (1) The number of blood platelets which are essential for normal blood coagulation are decreased; (2) A delay occurs in blood coagulation; (3) Finally, the capillary blood vessels may be directly damaged by irradiation and allow blood to seep into the tissues.

Because transfused platelets are quickly destroyed, there is no effective treatment for this platelet deficiency. Further research is needed on this problem.

The altered coagulability of the blood offers somewhat more hope for treatment. Toluidine blue, a basic aniline dye, given intravenously, apparently neutralizes the substance that delays coagulation. However, other factors not yet known also contribute to the delayed coagulation, and these are not influenced by this dye. A number of drugs such as rutin and vitamin C are considered useful in the treatment of capillary injury, and they may be useful in the treatment of irradiation bleeding.

Infection.—At Hiroshima and Nagasaki, infection as well as hemorrhage was said to account for many of the fatalities occurring between the second and sixth week.

Irradiation destroys tissue in the gastrointestinal and respiratory tract and permits easy entry of bacteria from these areas into the body. Of equal or greater significance than the ease with which invasion occurs is the fact that once the bacteria enter the blood stream, they meet with little resistance, because the protective white blood cells are nearly absent and the specific antibodies of the blood are weak and ineffective. Attacking the invading organisms with antibiotics, particularly aureomycin, has proved to be the most effective method not only of combating infection but in prolonging life in irradiated dogs.

With aureomycin treatment there is considerable delay in the development of the expected weight loss, weakness, and loss of appetite. Aureomycin also retards the appearance of the anemia and low white cell count. However, there is no change in the lowering of platelet counts.

Blood transfusions combined with

aureomycin are even more effective than aureomycin alone in the treatment of irradiation sickness. This combined treatment not only prolongs life to otherwise fatal exposure in dogs, it also permits some to survive doses of irradiation of about 25 per cent above the usual minimum fatal exposure. Because irradiation sickness in man is nearly identical with that observed in dogs, it is expected that blood transfusions and appropriate antibiotics should help save lives in many cases otherwise doomed to a fatal outcome.

Malnutrition.—Except for the day of irradiation, most individuals can be expected to eat well for a period of a week or more after exposure. Thereafter, diarrhea and loss of appetite may occur to a varying degree and be responsible for the rapidly developing state of starvation and weight loss. Food is completely rejected during the last day or two of life. The accompanying fever and the accelerated breakdown of body tissues contribute to the weight loss in addition to the lack of appetite. Because food requirements are increased and intake decreased during irradiation sickness, it is necessary to provide additional food for the patient by administering blood, plasma, and other substances intravenously. Salt solutions given by vein may be required to combat water and salt loss from vomit and diarrhea. In addition, glucose and vitamins should be given.

MEDICAL ORGANIZATION AND SUPPLIES

Who is to be treated?—The requirement of medical personnel and supplies in the event of an atomic disaster is prodigious if the immediate survivors are to be effectively treated. Unless complete preparation can be made in advance, only a small segment of the surviving population can be treated. Deciding which survivors are to be treated is a terrifying responsibility for anyone, especially for the physician. Inevitably, many of these decisions will be in error.

Several factors must be considered in selecting those victims to be treated. The first is the distance of the survivor from the site of the blast. Secondly, persons, even though in a zone ordinarily considered inevitably fatal, may be sufficiently shielded from irradiation to permit survival. These patients should be treated. Another factor is the residual radioactivity present as measured by Geiger counters. Treatment will be more successful in patients found in areas of low radioactivity, but here, too, individual exceptions must be made.

For example, an individual close to the source of the blast but protected from irradiation by concrete might be rejected for treatment because of his geographical location. Yet such a patient might be able to survive if suitable treatment is provided. Likewise, a patient in a zone of low irradiation may suffer considerable bodily injury (fractures, wounds, burns, etc.) and be wrongly rejected because of the extent of his local injuries, when adequate immediate care would enable him to recover.

The merits of each case, therefore, must be considered as carefully as possible before any selection is finally decided.

Personnel requirements.—Physicians, nurses, and hospitals normally function in central locations and thus are particularly vulnerable to atomic attack. For this reason, in case of bomb attack, lay personnel and improvised hospital facilities will have to carry the bulk of the load. An extensive educational program and the planning for emergency facilities is imperative.

Because irradiation sickness may not incapacitate the victim for several days, all those able to walk must not only leave the radioactive areas but must go to outlying, previously designated medical centers before irradiation symptoms are apparent. Those receiving body injuries as well must be treated by local first-aid stations and then rapidly evacuated to such centers for subsequent treatment of irradiation sickness.

Blood and plasma.—Facilities for the rapid collection and distribution of enormous quantities of blood will be required, because thus far no effective method for the storage of whole blood beyond twenty-eight days has been devised.

For every person receiving serious irradiation and physical injury, at least fifteen donors probably would be required. Those less seriously injured will require from four to ten donors. To treat effectively half a million casualties with serious irradiation sickness, 7½ million pints of blood would probably be required over a thirty-day period. This figure is nearly one half the entire amount drawn in the United States during World War II.

Plasma, on the other hand, can be stored indefinitely, and therefore huge stockpiles could be effectively concentrated in critical areas. The value of plasma in the treatment of shock from hemorrhage and burns is well established, but it is not yet known whether plasma is effective in combatting irradiation sickness. In many instances, whole blood would also be required, particularly in combatting anemia.

There will be an even larger immediate need for blood and plasma to treat shock of burns, lacerations, and bodily injuries incurred by the immediate blast and fire. No one can estimate what these requirements may be, if these patients are treated according to modern medical concepts. According to the experience at Nagasaki, the need for treatment of these wounds diminishes rapidly so that at the end of five weeks, surviving casualties suffer primarily from irradiation sickness. Many of those Nagasaki victims who died after the third week might have been saved had adequate medical care been available to combat the latent effects of irradiation.

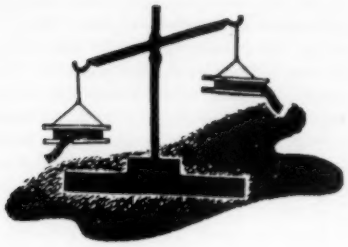
Antibiotics.—In the past, where large-scale disasters have occurred, active immunization has been of great value in preventing tetanus and waterborne disease such as typhoid. This approach will be of little value in irradiation injury. Under these circumstances, not only is the body incapable of responding to these injections with the production of antibodies, but those antibodies already present in the body may deteriorate progressively. This situation can be partially remedied by the injection of previously formed antibodies such as those prepared in tetanus antitoxin.

The liberal use of antibiotics, in conjunction with other therapy, will be the most effective way of treating and preventing the infections complicating irradiation injury. This treatment must be begun before the patient's status can be fully evaluated, which may require several days. Since several different antibiotics may be required by each patient, the needs for these drugs greatly exceed present supplies. Therefore, special stockpiling of antibiotics would be imperative.

Drugs and dressings.—In conjunction with supplies actually needed for treatment of irradiation sickness, surgical dressings, sedatives, and other drugs would reach unprecedented demand. These considerations are important but beyond the scope of this paper.

This article has sketched some of the main outlines of the medical problems presented by the atomic bomb. From these facts, it is obvious that civil defense requirements in event of atomic warfare vastly exceed those of all past medical experience. The atomic bomb presents a challenge to civilian preparedness inconceivably greater than ever faced in human history.

HISTORY OF CIVIL DEFENSE IN THE UNITED STATES



Elwyn A. Mauck

This summary of civil defense organization and activity in the United States since World War I has been prepared by the Director of the Department of Legislative Reference in the Maryland Fiscal Research Bureau. Mr. Mauck was formerly Professor of Government at the University of Maryland. He is the author of a more detailed report, "Civilian Defense in the United States, 1940-1945."

FIVE years after abolition of the World War II Office of Civilian Defense, there is a recurrence of intense interest and concern throughout the United States in the problem of civilian protection against the effects of direct enemy attack.

Since many current civilian protection problems do not differ in kind from those encountered by the people of the United States in World Wars I and II, a brief history of civilian defense agencies and programs during those conflicts may be of value in planning for comparable contingencies under existing conditions. The dangers of incendiary bombs, gas, and bacteriological warfare have remained, and the planning of counter-measures must continue. The addition of a more effective demolition bomb in the arsenals of our potential enemies requires that we consider not only blast dangers but also those related to radioactivity. Protective construction, identification of contamination, diagnosis of symptoms, medical treatment, and similar civilian defense problems must be re-evaluated. Study must be given also to past problems of organization, procedures, allocation of authority, and determinations of basic policy. Blind adherence to such past methods could be fatal, but sound logic requires building upon the basis of what experience has taught.

EXPERIENCE IN WORLD WAR I

During World War I, there was no need for civilian protection as currently conceived, but the Secretary of War exercised supervision over many activities later embraced in the term "civil defense." State and local defense councils were organized in every state to direct volunteer activities in the fields of public health, welfare, morale, economic stability, Americanization, and conservation and production of critical material. The state and local activities were guided by the Council of National Defense, of which the chairman was the Secretary of War. Such guidance was provided through its State Councils Section, created April 6, 1917.

On April 21, the Council appointed also an 11-member Woman's Committee to coordinate and stimulate the war activities of the nation's women.

Because of inevitable conflict and duplication of activities at both the state and local levels, the State Councils Section and Woman's Committee were merged into the Field Division of the National Council on October 1, 1918. The Secretary of Interior was made chairman, and the chairman of the Woman's Committee became vice-chairman of the new division. However, amalgamation was effected in only three states when the armistice was signed approximately a month later.

At the local level, county defense councils constituted the usual pattern, and, in the southern states, Negro councils were established subordinate to white councils. The county councils, in turn, established community councils which constituted the groups actually engaged in the activities involving civilian participation. By October 1918, there had been 120,000 community councils established. Eventually there were women's units in 80 per cent of the counties, and by October 1918, the city, town, and township organizations numbered 14,000.

At no time did the defense councils or women's committees engage in what later became identified as civilian protection activities. Invasion of the United States was only a remote possibility, and aviation was in its infancy. The amount of successful enemy sabotage proved to be slight. Nineteen states created home guards, but their activities probably would have been in the military field in the event of a threatened or actual invasion rather than in the field of "passive" protection.

CIVIL DEFENSE IN WORLD WAR II

The outbreak of the war in Europe in September 1939 caused local, state, and federal governments to review the civilian defense organizations they had formed in the former conflict and to re-establish similar machinery to meet the new emergency. The Council of National Defense was revived on the basis of the 1916 legislation, and on May 29, 1940, President Roosevelt called upon it to direct the nation's defense program. An Advisory Commission, similar to one utilized in World War I, again was appointed by the President. However, the various subordinate units, including the Division of State and Local Cooperation, were on this occasion made responsible to the Advisory Commission rather than to the Council of National Defense. On August 2, 1940, the President advised state governors to re-establish state and local councils if they considered such action warranted. Many of the states had already done so.

The Division of State and Local Cooperation immediately became responsible for several emergency functions.

One of the most immediate and pressing problems confronting it was that of easing the impact of rapidly expanding defense industries upon congested communities. It surveyed industrial facilities and manpower, as well as community needs, through state and local defense councils. The Lanham Act, providing aid for areas greatly affected by wartime industrial expansion, grew, at least in part, from this activity.

Gradually, the Division entered the civilian protection field. In November 1940, it formed an Advisory Committee on Fire Defense which, after studying the effects of incendiary bombs dropped on London, instituted the program under which the Chemical Warfare Service of the War Department trained local fire department personnel in techniques of combatting the new menace. Also, the Division issued a bulletin on protective construction based on a study of the effects of demolition bombs. It planned to issue further publications on air raid protection, medical care, warning systems, blackouts, and similar subjects, but it was abolished before it had an opportunity to do so. It entered into an agreement with the War Department under which it would furnish volunteers for the Aircraft Warning Service, a function subsequently performed by its successor, the OCD.

THE HISTORY OF THE OCD

Fiorello La Guardia, mayor of New York and president of the U.S. Conference of Mayors, spearheaded the movement that resulted in replacement of the Division by the Office of Civilian Defense. After sending a New York City mission to observe London under the "blitz," he announced in a report prepared by the mission that "passive or civil defense" was a burden to be borne primarily by cities rather than by states.

An executive order providing for an "Office of Home Defense" drafted by the budget bureau was reviewed by a committee appointed by the President and approved by the Secretary of War. The name "Office of Civilian Defense" was adopted.

La Guardia believed the proposed executive order placed inadequate authority in the new agency, but he agreed to accept the directorship on the condition that he retain his position as mayor of New York. The order was issued and his appointment announced on May 20, 1941.

The Office of Civilian Defense operated in an environment of controversy during most of its existence. Several of its programs were severely criticized by members of Congress. The more unusual aspects of OCD's programs and some of its personnel, received frequent unfavorable publicity. Internally it was plagued with uncertainty of objectives, ineffectual and indecisive management, conflicts of personalities, and faulty organization. Despite these defects, certain programs it undertook were highly successful, while others could not be evaluated with finality since they never were tested by enemy air raids.

Upon assuming office, Director La Guardia immediately proceeded to organize on the basis that protection was the only important aspect of civilian defense; he dismissed the health, welfare, nutrition, child-care, housing, physical fitness, and similar programs as "sissy stuff." Major activity was to be centered in nine regional offices located in headquarters cities of the Army corps areas.

The protection program developed rapidly under the director's dynamic leadership. Streams of material were sent to state and local councils regarding warning systems, protective shelter, and the training of air raid wardens, first-aid workers, rescue squads, auxiliary medical personnel, decontamination squads, auxiliary policemen, auxiliary firemen, and aircraft spotters.

In the initial phases of organization, the non-protective aspects of civilian defense as outlined in the executive order were virtually ignored. No operating units were created despite repeated attempts by the Bureau of the Budget to stimulate the director's interest in the sum-total of his responsibilities. Also urging him to develop this non-protective phase was Mrs. Eleanor Roosevelt, until eventually he asked her to become an assistant director to undertake the task of organizing it. Her appointment was effective as of September 22, 1941. She immediately directed the development of nation-wide programs that were most successful, especially the establishment of volunteer offices.

However, Mrs. Roosevelt's five months in OCD proved turbulent. The volunteer talent program under the direction of Melvyn Douglas was attacked as frivolous, and the employment of a stage dancer, Mayris Chaney, in the physical fitness program became the subject of ridicule. Mrs. Roosevelt was especially vulnerable to criticism as the President's wife, and American entrance into the war two months after her appointment merely added to the criticisms that the activities she directed merely diverted from the war effort. The Chaney-Douglas incidents caused OCD to lose prestige which it never fully regained.

Mrs. Roosevelt resigned when she believed the programs for which she was responsible were sufficiently well established. She recognized that her continuance in office might do more harm than good to the agency.

Early in 1942 it became apparent to the President that OCD required a full-time executive, and on January 12 he appointed James M. Landis, Dean of the Harvard Law School, as special assistant to the President to devote his full time to the executive work of OCD. Mayor La Guardia resigned the directorship on February 10, and Dean Landis assumed full jurisdiction, although his formal status was not changed to that of director until April 15.

The new director engaged in extensive reorganization of the agency. He strengthened the Washington office and the regional offices by recruitment of new top personnel. He abolished the positions of the inspectors-general on the ground that the incumbents were technically incompetent for their jobs and the positions were superfluous. Some of the programs that had been subjected to greatest criticism were transferred to other agencies. Thus, the physical fitness program went to the Office of Defense Health and Welfare Services. A "Know-Your-Government" information program was abandoned, as were various "youth activities." Most important, he secured the issuance of a new executive order that strengthened the agency considerably. It omitted the agency's responsibility "to sustain national morale," and, as Director Landis stated at the time of its issuance, "It streamlines OCD for war."

Landis resigned as director in August 1943 when it was becoming increasingly apparent that there probably would be no enemy air raids requiring extensive use of the civilian protection forces. In his letter of resignation, which was not made public, he recommended abolition of the agency, with transfer of protective services to the War Department and of mobilization services to the Federal Security Agency. He stated that the developmental stages had ended and that the state and local defense councils could take responsibility for their civilian defense programs with a minimum of national guidance. The Director of the Budget disagreed with the recommendation, and President Roosevelt chose to continue the agency.

Deputy Director John Martin became acting director of the agency and performed in this capacity for the following six months. Again morale in

the agency suffered because of uncertainties regarding its continuance and because of complete silence throughout the six months regarding the authority, powers, and future status of Mr. Martin.

On November 1, 1943, the War Department advised OCD that, "Token raids are always a possibility, but the present degree of danger of enemy air attacks should be taken as a calculated risk and our civilian population should be conditioned accordingly." In the following months the protection services in state and local communities were placed on a stand-by basis. Mr. Martin resigned in February 1944 to accept a commission in the Navy and was succeeded by Lieutenant General William N. Haskell.

The basic characteristic of General Haskell's administration, covering the final fifteen months of the agency's life, was gradual curtailment of its activity pointing to early termination. When agreement regarding the time of termination could not be reached, the question was referred to President Truman who directed that the agency be abolished June 30, 1945.

PROTECTIVE SERVICES OF THE OCD

Never fully answered will be the question of whether the protective services established by OCD would have been adequate in the event of mass enemy air raids. With the exceptions of several minor incidents involving the shelling of the American coast from submarines and the Japanese balloons carrying demolition and incendiary bombs into the heart of the country, none of which resulted in any substantial damage, there were no enemy attacks on continental United States. There had been organized and trained at the peak of defense activity approximately six million volunteers enrolled in the protective services on the Atlantic and Pacific coasts, and in the belief that inland areas were also vulnerable, protective services were organized in all large and many small urban areas.

CITIZENS DEFENSE CORPS

In order to establish and maintain minimum national standards of training, the OCD established the United States Citizens Defense Corps, consisting of all eligible volunteers in protective services. Standards of training, age, and citizenship were established, and an oath of loyalty was administered to each member upon his admission to the corps.

COMMUNICATION SYSTEM

The communication system, consisting of several units, constituted the nerves of the civilian protective organization at the state and local levels. The key man was the air raid warden who directed all civilian protection activities in his geographical area. Every local defense council maintained a control center which received the warning messages from the War Department's Aircraft Warning Service and which transmitted such messages to key defense personnel and to the general public. It directed the activities of protection volunteers during air raids, blackouts, and drills. In a later stage of organization, the warnings were routed through state defense council control centers to effect greater coordination. The regional and national offices of OCD established "war rooms" to organize air raid defense activities on a regional and national basis, but these were not developed beyond a rudimentary stage.

Changes in instructions and complexity of the signals in the public alarm systems caused considerable confusion and criticism, but eventually the signals were understood by most urban citizens and were accepted. Agreements were reached with telephone companies regarding priority of civil defense messages. A unit known as the War Emergency Radio Service was established to organize amateur operators to serve if the telephone system were disabled and commercial stations had to be closed because they would provide a "beam" for attacking planes. Eventually 5,213 radio transmitters were licensed under the WERS program, and they proved to be of inestimable value in several disasters involving floods, fires, and hurricanes.

The messenger service constituted another unit in the defense corps that was part of the communications system. Between 300,000 and 400,000 persons were enrolled as messengers during the height of civil defense activities.

FIRE PROTECTION

Since 80 to 90 per cent of the air raid property damage in England was caused by fire, first priority was given to the training of volunteers to combat incendiary bombs and fire. A special fire unit was organized to protect forests against accidental fire, air raids, and sabotage. In addition to organizing volunteer fire fighters, the national agency also cooperated in fire defense by the loan of large quantities of fire-fighting equipment.

SHELTERS

Shelter policies and programs were formulated by OCD for the guidance of states and municipalities to protect their citizens from strafing from planes, explosions of bombs, and flying debris. For delayed action bombs or apparent "duds," the Office of Civilian Defense issued instructions regarding dispersion of persons from the threatened area. Descriptions for the purpose of identifying certain types of bombs used by the enemy were given wide public circulation. Selection of shelter areas, design of shelter signs, reduction of the hazards of flying glass, and similar matters were subjects upon which detailed instructions were issued by OCD. The major Defense Corps unit involved in protection from demolition bombs was the rescue service. Members of this service were trained in first aid, tunneling, shoring, and other techniques necessary to their essential functions of releasing living persons or recovering bodies from debris or damaged buildings.

PROTECTION AGAINST GAS

It had been freely predicted that war gas would be used against civilians despite the Geneva Gas Protocol of 1925. The OCD established gas reconnaissance and decontamination units as parts of the Defense Corps. It issued informational material regarding identification of war gases, self cleansing, and decontamination of gassed areas. It distributed gas masks and protective clothing on a loan basis for civilian defense workers who necessarily would be exposed to the gas. Instruction was given to the general public regarding gas proof shelters in the home and emergency self-cleansing methods.

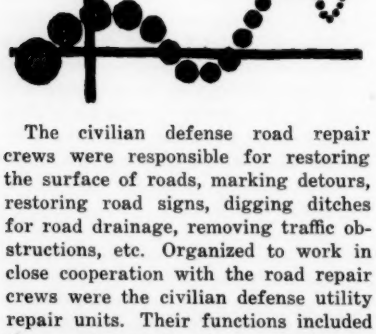
CAMOUFLAGE

Protective concealment constituted another important aspect of civil defense against enemy air raids. Blackout drills were organized in virtually all urban communities in the nation. The Army assumed jurisdiction in the matter of ordering such tests, but the

Office of Civilian Defense issued detailed instructions and advice regarding methods of blackout, interior lighting under blackout conditions, and other pertinent information. The art of camouflage was the subject of further detailed instructions by the agency. Rather than recommending elaborate and expensive camouflage projects, it encouraged the use of low tone color in maintenance painting, inconspicuous parking spaces, conservation of trees, avoidance of ground scars and earth piles, and effective dispersion of buildings in new construction. Some local defense councils, notably that of the Chicago Metropolitan Area, experimented with smoke screens to conceal their communities and developed them to a high degree of perfection.

RESTORATION OF ESSENTIAL SERVICES

Various units were organized to provide and restore after air raids such services as transportation, traffic control, general safety, policing, and public communications. A drivers' corps was established to assist other units of the Defense Corps through providing them with vehicles and drivers. The OCD issued detailed instructions to local defense councils on organizing transportation of goods and persons under emergency conditions. Methods of marking emergency routes, directing traffic, and planning a motor convoy system were outlined. The OCD sponsored several training courses for truck drivers employed by large transportation companies. The auxiliary police were charged with direction of traffic under emergency conditions, patrol work, prevention of looting at scenes of disaster, enforcement of blackout restrictions, and similar duties.



The civilian defense road repair crews were responsible for restoring the surface of roads, marking detours, restoring road signs, digging ditches for road drainage, removing traffic obstructions, etc. Organized to work in close cooperation with the road repair crews were the civilian defense utility repair units. Their functions included the repairing of water, gas, electric, telephone, telegraph, steam, sewer, and other utilities damaged by enemy action. Another unit closely allied to the foregoing two was the volunteer demolition and clearance unit. Its functions included removing rubble and debris from the streets and destroying partially demolished or unsafe walls and buildings.

EVACUATION

The emergency evacuation service was established to move large groups of people in anticipation of or subsequent to bombing attacks. Its problems included those of timing, transportation, housing, and the general welfare of the evacuees. State and local communities were advised not to effect any movement of peoples or to develop their programs beyond the planning stage until such time as a changed military situation might warrant it. Actual evacuation was to have been financed in large part by the Federal Government, and the final decision to evacuate an area would have been the responsibility of the appropriate service command of the Army. The Office of Defense Health and Welfare Services and the American Red Cross were to play prominent parts in any evacuation program.

WELFARE SERVICES

Distinct from the evacuation service, the OCD also organized an emergency welfare service to coordinate all community welfare resources irrespective of whether the emergency resulted from the mass movement of persons or some enemy action not resulting in evacuation. In an area evacuation, the emergency welfare service would operate at the evacuation areas, the reception areas, and during transportation between the two points. In all welfare programs, existing public and private welfare agencies were to continue to administer functions for which they were appropriately equipped and staffed.

MEDICAL PROGRAM

The medical program of the Office of Civilian Defense was organized by personnel assigned from the U.S. Public Health Service to provide instruction in the medical aspects of civilian protection against war gas, demolition bombs, and fire, to establish hospital units for care and treatment of casualties, recruit nurses' aides, and to prepare an emergency mortuary service. Mobile medical teams were established at the community level, casualty stations designated, gas-cleansing stations equipped, and the emergency mortuary service organized. For the seriously wounded, casualty receiving hospitals were designated and prepared to receive and care for emergency patients prior to their transfer to emergency base hospitals. Both casualty receiving and base hospitals were to be reimbursed by the U.S. Public Health Service at the rate of $4.25 per patient per day. OCD distributed on loan ambulance bodies, hospital beds and mattresses, medical kits, blood plasma, and morphine to strategic points throughout the United States.

CIVIL AIR PATROL

Some protection activities of OCD were not directly related to air raids. Thus the Civil Air Patrol engaged in courier service and in forest patrol, spotted and bombed submarines, and performed other similar functions. The nation's industrial plants not directly related to the military effort were brought under OCD's facilities security program. This program included not only protection from air raids, but also from the older techniques of sabotage, and it included measures designed to reduce accident rates at a time when loss or diminution of production, communication facilities, or transportation could prove most serious.

The Office of Civilian Defense also was specifically charged through Presidential proclamation with responsibility for initiating fire protection programs designed to make all persons more fully aware of the dangers from fire. Noticeable reductions in fire losses were observed following the fire safety education campaign sponsored by the agency.

WORK OF THE BULL BOARD

All civilian protection programs terminated June 30, 1945, with the abolition of OCD, except the Civil Air Patrol which had been transferred to the War Department several years previously. With the end of the war in sight, all other programs were allowed to lapse. A year and a half later, however, plans were initiated once more to survey the civilian protection needs of the nation. In November 1946, the War Department established a Civil Defense Board (under the Presidency of Major General Harold R. Bull) to determine the War Department's views and policies on allocation of responsibilities for civil defense to existing or new agencies, the responsibilities that should be handled by the War Department, the structural organization from the national level down to the

operating groups with the authority that would have to be vested in such organization, and the immediate action that should be undertaken by the War Department pending the above determinations.

After more than a year of study the Board made its report in February 1948. The major premises of the so-called "Bull report" included the following assumptions: (1) "The fundamental principle of civil defense is self help"; (2) Each level of government has responsibility for organizing, training, and equipping for civil defense including use of mutual aid devices; and (3) "The major civil defense problems are not appropriately military responsibilities" because "such problems are civilian in nature and should be solved by civilian organization." It recommended that the proposed National Resources Board serve as the policy group, that the Secretary of the Armed Forces (later the Secretary of Defense) "be responsible for over-all coordination of civil defense," and that there should be created a Civil Defense Agency separate from Army, Navy, and Air Force, reporting directly to the Secretary of Defense.

THE HOPLEY REPORT

To develop the plan in greater detail, the Secretary of Defense in March 1948 established the Office of Civil Defense Planning and named Russell J. Hopley as director. Mr. Hopley was requested "to prepare, and to submit to the Secretary of Defense, a program of civil defense for the United States, including a plan for a permanent federal civil defense agency which, in conjunction with the several states and their subdivisions, can undertake those peacetime preparations which are necessary to assure an adequate civil defense system in the event of war."

After six months of study the Office submitted its report.[1] It recommended the establishment of a national office with a small staff to furnish leadership and guidance in organizing and training the people for civil defense, but urged that basic operational responsibility be placed on states and communities. It recommended that the Office of Civil Defense be placed either directly under the President or the Secretary of Defense, although it favored the latter. Regional offices would parallel Army area commands, and state civil defense headquarters would operate under the governor. At the local level, the mayor or comparable official would be active head of civil defense, except for special arrangements required for metropolitan area organization. The report also embodied a model state civil defense act.

[1] A summary of the Hopley report appears in *Bulletin*, V (April 1949), 111, 126.

RECENT STEPS IN CIVIL DEFENSE PLANNING

In August 1949, the Secretary of Defense abolished the Office of Civil Defense Planning and created the position of Assistant for Civil Defense Liaison. The new office was asked to "provide full coordination within the national military establishment of planning in preparation for any military aspects of civil defense, any other civil defense matters assigned by appropriate authority as a responsibility of the national military establishment, and any voluntary civilian participation in related military defense activities, provide effective liaison and cooperation between the national military establishment and other governmental and private agencies with respect to all phases of such activity, and provide the several departments and staff agencies with a central source of technical information, advice, and assistance on civil defense matters in general."

The Department of Defense shifted from planning to liaison activity because the President had placed primary responsibility for civil defense planning in the National Security Resources Board. In a memorandum dated March 3, 1949, giving this assignment to the Board, the President stated, "I see no need to establish at this time a permanent organization, such as a proposed Office of Civil Defense. Rather, I see a definite necessity to continue planning for civil defense and an immediate need to fix in a responsible agency definite leadership for such planning."

The Board delegated primary responsibility for planning "wartime civil disaster relief" to the General Services Administration, and it assigned those phases of protective services involving "military defense" to the Department of Defense. The General Services Administration's assignment included fire fighting, medical services and supplies, rescue, evacuation, demolition, regulation of transportation and communications, and restoration of order, while the Department of Defense was assigned detection, observation and identification of aircraft, air raid warning systems, border patrol, anti-aircraft defense, civil air patrol, camouflage and protective construction. These assignments involved extensive coordination of the defense activities of other federal agencies, such as the Federal Security Agency, Atomic Energy Commission, and the Departments of Agriculture, Commerce, Interior, Treasury, and Justice.

On October 5, 1949, the National Security Resources Board sent to all state governors a statement of policies on relationships with state and local governments; and on December 1, 1949, the first of a series of bulletins outlining the objectives of the Federal Government followed. For example, it described the "Operation Lookout," conducted by the Department of Defense in September 1949, in which 12,000 volunteer civilians participated and which tested "the aircraft observer organization and facilities designed to supplement the radar detection system."

Practically all states have resumed their interest in civil defense, although in approximately one-third the activity has not developed beyond the planning stage. Over a dozen states enacted specific civil defense legislation within the past two years, and several others enacted disaster relief legislation sufficiently broad to include civil defense activities. In at least six states, civil defense legislation failed to pass after introduction in the 1949 session. Legislation for the District of Columbia is pending in Congress. In several states the World War II legislation is still in effect, and presumably they require no new laws.

In March and April 1950, the Joint Congressional Committee on Atomic Energy held hearings on civil defense against atomic attack. Witnesses included federal officials, representatives of the American Legion, mayors of cities, and directors of volunteer protection societies. All witnesses before the Committee agreed on the need for organizing once again for civilian protection. A number of the witnesses presented plans of organization and procedure for their proposed civil defense agencies. None proposed the inclusion of activities that were identified in World War II as volunteer participation, mobilization, or civilian war services. There was considerable divergence of opinion as to whether the agency should be placed within the Department of Defense or be answerable directly to the President. Many witnesses were emphatic that they wanted all civil defense instructions to issue from a single federal agency. The witnesses stressed the need for nation-

wide uniformity, but also they conceded that state sovereignty must be preserved. Their most emphatic criticism, however, was directed against delay. They believed that too much time already had elapsed and that the Federal Government should release further information regarding the nature of the dangers to be faced and protective measures to be taken. There was general agreement, too, that a large proportion of the cost of protective measures would have to be borne by the Federal Government.

As of this writing, the Joint Congressional Committee on Atomic Energy has just issued its long-awaited handbook on weapon effects.[2] No congressional group has proposed national legislation on the subject. Undoubtedly further legislation will be enacted in the 1951 sessions of the state legislatures, and many urban communities already have organized training courses. A worsening of the international situation should accelerate the defense programs, but under present circumstances it appears obvious that careful planning and extensive organization and training in civilian protection must be established if the United States weighs candidly its requirements for survival and victory in possible future wars.

[2] U.S. Atomic Energy Commission. *The Effects of Atomic Weapons.* Prepared for and in cooperation with the U.S. Department of Defense and the U.S. Atomic Energy Commission under the direction of the Los Alamos Scientific Laboratory. Washington: Government Printing Office, 1950. Pp. 456. $1.25.

The Hydrogen Bomb

Recently a series of articles on the hydrogen bomb, based on material published in the Bulletin of Atomic Scientists, appeared in hundreds of American newspapers.

Reprints of this series can be obtained for ten cents a copy (to cover handling and mailing costs) from the business office of the Bulletin of the Atomic Scientists, 53 W. Jackson Blvd., Chicago 4, Ill.

CHRONOLOGICAL LIST OF EVENTS IN CIVIL DEFENSE

August 29, 1916—Council of National Defense established by act of Congress.

April 9, 1917—State Governors requested to establish councils of defense.

November 11, 1918—Armistice results in rapid dissolution of state and local defense councils.

May 29, 1940—President calls on Council of National Defense to direct nation's defense programs.

August 2, 1940—State Governors advised to re-establish defense councils.

August 5, 1940—Establishment of Division of State and Local Cooperation by Advisory Commission to the Council of National Defense announced.

May 10, 1941—London experienced its worst air raid of the war.

May 20, 1941—U.S. Office of Civilian Defense established and Fiorella La Guardia named director.

September 22, 1941—Mrs. Eleanor Roosevelt appointed to administer the non-protective aspects of civilian defense. Resigned February 20, 1942.

February 10, 1942—Mayor La Guardia succeeded by James M. Landis as director of OCD.

April 15, 1942—Executive Order 9134 reorganized OCD upon a war basis.

May 19, 1942—Executive Order 9165 placed responsibility for facility security program upon OCD.

August, 1943—Director Landis resigned and recommended abolition of OCD.

October 4, 1943—War Department announced that Aircraft Warning Service would be placed on stand-by basis.

May 4, 1945—President Truman signed executive order abolishing OCD June 30, 1945.

August 6, 1945—Atomic bomb dropped on Hiroshima.

November 25, 1946—War Department creates Civil Defense Board to study the problem. Reported February 1948.

March 27, 1948—Secretary of Defense establishes Office of Civil Defense Planning. Reported October 1, 1948.

March 3, 1949—National Security Resources Board given primary responsibility for civil defense planning.

June 3, 1949—NSRB requested Federal Works Agency (which later became General Services Administration) and Department of Defense to develop civil defense plans.

August 1, 1949—Department of Defense establishes position of Assistant for Civil Defense Liaison.

August 23, 1949—General Services Administration submitted planning prospectus to NSRB.

September 1949—Department of Defense held "Operation Lookout" in ten northeastern states to test air defenses.

September 23, 1949—Prsident Truman announced that an atomic explosion had occurred in Soviet Union.

October 5, 1949—First communications sent from NSRB to all state Governors regarding civil defense.

December 1, 1949—First of a series of NSRB Civil Defense Planning Bulletins sent to Governors.

January 31, 1950—President directed Atomic Energy Commission to study possibilities of building thermonuclear (hydrogen) bombs.

March 17, 20, 23, 30 and April 3—Hearings on civil defense by Joint Congressional Committee on Atomic Energy.

June 29, 1950—Atomic Energy Commission disclosed that "great steps" had been achieved in developing the hydrogen bomb.

August 8, 1950—AEC Issued Weapon Effects Handbook.

PREPARING NOW FOR CIVIL DEFENSE RESPONSIBILITY

S. A. Anthony, Jr.

Mr. Anthony is the Chairman of the Civilian Protection Group in New York City—a volunteer organization formed in May 1948, which has been holding monthly seminars to study the problems of civilian and industrial preparedness for protection in atomic war. In this article he discusses the contributions which can be made by unofficial volunteer groups in training leaders for civil defense programs, and includes a bibliography on civil defense for the use of such study groups.

CIVIL Defense is actually democracy at work.

The term is a misnomer in many senses. More appropriately, it should be called civilian protection. Defense is a military responsibility, while it is the responsibility of the local governments and the citizenry to protect themselves.

The Federal Government must provide the over-all stimulus, set basic standards, train leaders, and coordinate planning. Prime responsibility for action must rest at the local level, with the state government providing controls, etc. Fundamentally, however, it is the local citizen who will, by his own efforts, make civilian protection effective or ineffective.

Dr. Paul Larsen, Director of Civilian Mobilization of the National Security Resources Board, has stated that federal planning is being done on a time schedule. This should result in total organization and effectiveness by January 1953. An orderly picture has been presented, and the board is obviously trying to create a plan and a program which will work. It is equally apparent that there is much to be done at the state and local levels *now* if we are to have adequate preparation.

There would seem to be some justification for the feeling that the prime initiating responsibility rests at the federal level. Such planning takes time, and, for that reason, it will not be realized immediately. We are informed that a basic plan will be available for the states in September, but that the states must start their own planning and preparation now so that they can complement and implement these federal recommendations.

Dr. Larsen informed the West Coast Mayor's Conference in June that "Civilians must take the responsibility for civil defense squarely on their own shoulders." In each community there is a small group of individuals who are leaders in its affairs. They have the welfare of the community at heart, and it is to them that the ball can be passed at this time with safety. They are the ones the community will look to for leadership in times of emergency, the ones who will step into the breach when needed. They know the elements of the area, its problems, and the men and women who can best perform the multitude of tasks that will arise when we need a civilian protection organization. They know what was good and what was bad in our World War II operations, the points of friction, and some of the easements. They were the wheelhorses of the past, and will be again in the future.

Leadership calls for special kinds of knowledge: an awareness of hazards, an acquaintance with people, the ability to handle individuals and assign them to tasks they can fulfil. The community will look to people thus qualified to acquaint themselves with the problems of any future war and what it may mean to the community. They will be expected to know the answers to many questions at the inception of civil defense programs in the community. What they learn now will help later.

The Civilian Protection Group has explored may of the problems that may face those leaders, whether volunteers or officials. It proposes that local authorities ascertain who are the leaders who can best help in preparing for civil defense and call an unofficial and informal gathering of a small group of these people to set up an unofficial volunteer study of their areas in advance of organization. There is much information available on the experiences of England, Germany, and Japan, as well as personal knowledge of the U.S. programs in World War II. A fair amount of data can be obtained about the effects of atomic weapons. There is also available data on other elements of modern warfare. These can be considered as background studies, preparing the leaders, volunteer and official, for a more intelligent appreciation of the problems and needs which will arise. They might concentrate upon an outline such as the following:

1. Weigh the strong and weak points in civil defense in the local community during World War II.
2. Consider the experiences of other countries during World War II and relate them to the local problems.
3. Study available data on the effects of the old and the new weapons of warfare that might be used against us.
4. In the light of the foregoing, survey the hazards and problems of the local community.
5. Begin an analysis of local manpower requirements for civil defense, and of those people available for specialized tasks.
6. Prepare for organization, training, and leadership of the local Civil Defense Organization.

Through discussions of an unofficial and informal nature, the greatest latitude can be achieved with the minimum of official and individual embarrassment.

To be effective, however, such sessions should include not only the potential civilian volunteer leadership, but those of the local authorities who will be equally responsible, and who will be working with the volunteer groups and their leaders. This will call for a careful selection of those who actually have the most to contribute to civil defense. Bringing together cross-sections of local authorities and volunteer leaders should result in an effective and intelligently organized civilian protection program for the community.

This is a plan for immediate action. Civil defense will function only as well as its leaders are prepared in advance to do their jobs.

Selected Bibliography of the Literature on Civil Defense

We have selected a preliminary reading list of available materials. No attempt has been made to assemble an exhaustive bibliography of all the known data on the subject, as a majority of the items on such a list would be difficult for most people to obtain and the quantity of them would be confusing to the layman. It is suggested that local groups gradually assemble a library of authoritative materials relating to civil defense, modern warfare, morale, and those other elements pertaining to the safety and protection of the community.

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CIVIL DEFENSE ACROSS THE NATION

EFFORTS ON THE NATIONAL LEVEL

The Federal Government's interim plan for coordinating state and local civil defense measures will be completed and sent to state governors early in September. This temporary "emergency" plan, prepared by the Office of Civilian Mobilization of the National Security Resources Board, will have to suffice until the long-range federal plans can be perfected. These are not expected to be complete before 1952.

In the early fall, possibly October, the Civilian Mobilization Office will publish a handbook giving precise directions to citizens on what to do if atomic attack comes.

Three exercises involving mock atomic attacks were planned for three American cities—Washington, Seattle, and Chicago—and have been carried out in two of them. Chicago's test is set for September 11. The National Security Resources Board will use the results of these tests in compiling a manual for the guidance of states and cities.

The creation of a Health Resources Advisory Committee was announced on August 4 by the chairman of the National Security Resources Board. The new Committee, whose chairman will be Dr. Howard Rusk, will coordinate the many questions of policy concerning health, hospitalization, and medical services and advise the NSRB on such matters as the allocation of doctors, dentists, nurses, etc. For the first time all national health resources will be brought together under one federal agency.

It is expected that new federal legislation establishing a formal Civil Defense Office will be proposed this fall or early in 1951. The present Office of Civilian Mobilization is a subsidiary planning agency of the National Security Resources Board, with no permanent functions or funds. The various functions of civil defense are divided among some twenty-seven government agencies, and jurisdictional disputes have already hindered progress.

The American National Red Cross announced recently that it was ready to complete the first-aid training of 20,000,000 persons in the United States within two years, and, if necessary, quadruple its blood collection rate of 60,000 pints a month. A first-aid training course is to be given throughout the nation this autumn. The Red Cross is the agency bearing the responsibility for procuring blood for the armed services and for coordinating the work of the blood-collecting agencies in supplying both the military and civil defense programs. On August 4 the Atomic Energy Commission announced a special research project to seek improved means of separating and preserving blood components, the project to be administered by the Red Cross, on AEC funds.

The Atomic Energy Commission has already completed the training of radiological specialists from nearly every state, who will train others in their states. There are 500 existing radiological detection teams under the Army and the AEC which could aid in handling sudden emergencies.

The program of the National Military Establishment is more advanced than that of the other federal agencies, although it, too, is not scheduled for completion before 1952. It will include an observation network over twenty-five Northeastern, Great Lakes, and West Coast states and will act as an adjunct to the Military Establishment's radar system. The operation of the network, when complete, will require 160,000 aircraft observers and 130,000 filter personnel—all of them civilian volunteers. The posts will assist in a civilian air-raid warning service.

RECENT ACTIVITIES IN THE STATES AND CITIES

Concern at the lack of preparedness by the states was expressed in early June by Mr. Paul Kennedy in a special article in the *New York Times*. At that time only twenty of the forty-eight states had any legislation through which a civil defense plan could be financed and implemented. Nine additional states had civil defense planning by executive direction. The remaining nineteen had neither civil defense legislation nor executive direction.

According to Kennedy, Washington officials took a poor view of the fact that a large number of the states had turned over whatever plans they had to the direction of the state adjutant general—usually the first state official

to leave the civil area in the event of hostilities. The Washington authorities have stressed that one of the most important factors in successful civil defense is its operation on an almost completely civilian level. Another cause for concern is the inability of the states to set up mutual assistance pacts in the event of an emergency; there are many legal barriers to the interchange of medical practitioners and a lack of standardization in disaster equipment.

The fighting in Korea has spurred state activity. Many states have moved to speed basic legislation and appoint permanent civilian defense directors.

NORTHEASTERN STATES

NEW YORK'S plans received great impetus on July 10 with the appointment of General Lucius D. Clay, former Military Governor of the American Zone in Germany, as chairman of the State Civilian Defense Commission. (The nine-man Commission—seven state department heads and two civilians—was created in January and given an initial appropriation of $100,000.) On July 20 General Clay appointed Lawrence Wilkinson, his former economic adviser in Germany, as full-time Director of Civil Defense for New York State. Upon taking office, General Clay promptly sent out instructions to the appropriate state departments, asking them to undertake the following tasks and report to his office within thirty days:

1. To mobilize construction resources of the state for the immediate repair of roads, rail, and airport facilities; to prepare inventories of materials and equipment in private and state hands; and to prepare a list of skilled workmen and engineers.

2. To prepare a complete mobilization plan for all welfare services.

3. To organize and train auxiliary firemen and policemen for defense purposes.

4. To canvass possibilities of providing temporary accommodation for one million persons and hospitalization for 150,000—and to establish a specific quota of evacuees to be received by each county and city outside the metropolitan area.

The N.Y. State Health Department has appointed a ten-man Medical Advisory Committee on Civilian Defense to aid General Clay and has announced that a post-graduate course in diagnosis and emergency treatment of victims of atomic attack will be available to every doctor in the state in early September. On August 9 General Clay issued a memorandum to the state's local defense directors describing the effects of atomic bomb explosions and giving detailed instructions as to how communities could minimize disaster.

State-wide air raid warning signals were defined on August 11.

By August 13, most of the principal cities of New York State had appointed local directors of civil defense. Forty-six communities, out of the fifty-two in which such appointments were expected, had named their local directors.

New York City. On July 10 Mayor O'Dwyer named former Police Commissioner Arthur W. Wallender full-time director of the city's civil defense. Less than a month later, on August 9, the city's organizational plan was made public, listing all the public and private agencies that will figure in the city's defense plan and describing their functions. Wallender has asked for an initial appropriation of $1,883,000 for air raid equipment, medical supplies, and radiation detection instruments. The cost of the full-scale organization is estimated at $43,000,000. The city has already cut its public works program to provide funds for civil defense.

The New York Board of Education has reactivated its Committee on Civilian Defense, which functioned during the last war to protect children, teachers, and parents. School superintendents have received instruction in defense measures appropriate to atomic warfare. City officials were instructed in the implications of atomic attack by the New York Operations Office of the AEC on July 26. The city plans to enroll an auxiliary police force of 40,000 men and women (10,000 auxiliaries were enrolled in the last war).

A plan calling for the construction of huge underground shelters in city park areas, roughly estimated to cost $450,000,000, was submitted in a report from the City Planning Commission and is under consideration. Federal aid would have to be sought for such a plan, and those arguing its merits point out the usefulness of such shelters as peacetime parking areas.

NEW JERSEY'S director of Civil Defense, Leonard Dreyfuss, announced on July 15 that his state was preparing to provide food, shelter, and emergency medical care for one million evacuees from New York City in the event of atomic attack. New Jersey passed civil defense legislation in January 1950, and plans have been under consideration for a year. To date, however, the state has allocated only $8,300 for its program. By mid-July local defense committees had been formed in 480 of the 566 communities, and 203 communities had organized pools of volunteers to be trained as policemen or firemen. A mock atomic bomb raid is being planned by the state for Newark within the next few months. A survey of housing facilities to care for New York evacuees is being made.

Mr. Dreyfuss, the New Jersey Director, is chairman of the Eastern Conference of State Civil Defense Directors, an organization of state officials formed in April of this year and including representatives from twenty eastern states. The New Jersey state plan is considered a model by many of the states in the conference.

MASSACHUSETTS. The Massachusetts legislature enacted a state civil defense law at the end of July, giving Governor Paul A. Dever almost unlimited emergency powers in the event of an enemy attack or any disaster. John F. Stokes, public safety commissioner, was appointed defense agency director. The Governor has announced the appointment of a team of atomic scientists living in the state who will give advice and aid in an emergency. A committee of scientists at the Massachusetts Institute of Technology are studying the underwater burst at Bikini to estimate what would happen to Boston should an atomic bomb be exploded in the harbor.

Cambridge is well ahead with local plans. With more than 300 uniformed auxiliary policemen organized since May, it has already held several "disaster" tests. In mid-July the Massachusetts Mayors Association announced that, in the absence of a federal plan, it was sending its plan, "The Cambridge Plan Against Atomic Attack," to the mayors of 104 large cities, and offered smaller cities a copy of the plan available through Mayor William P. Grant of Fall River, Massachusetts. The suggestion from federal officials that other cities follow Cambridge's lead has resulted in many inquiries directed to the Cambridge city manager.

MAINE. Legislation was enacted in 1949. Colonel Spaulding Bisbee, state civil defense chief, reported that four mobile defense battalions of 180 men each had been organized in June and were being trained to handle disaster control in Portland, Lewiston, Augusta, and Bangor. These units will be ready by fall and perhaps sooner.

VERMONT. The Vermont legislature authorized the setting up of civil defense committees in 1949. Former Marine Corps General Merritt Edson is in charge. The committee chairmen met with state agency officials on August 14.

NEW HAMPSHIRE. Legislation was enacted in 1949. Rear Admiral Miles Browning is civil defense director. Plans were reported to be ready for presentation to Governor Sherman Adams in mid-August. Late in June a meeting of the State Civil Defense Commission was called to take stock of New Hampshire's facilities for caring for evacuees from the eastern seaboard.

CONNECTICUT has provided for planning by executive direction. Coordination of emergency services has been placed under the direction of George J. Hickey, state commissioner of police. On July 7 Connecticut cities and towns were asked to recruit auxiliaries for police and fire services and to institute training courses in first aid, traffic and crowd control, emergency communications, rescue work, and fire fighting.

The construction of large underground shelters for Hartford and other Connecticut cities is being discussed.

RHODE ISLAND's civil defense program operates under World War II legislation, with the state adjutant general in charge. There are plans for a nineteen-member emergency council, but the appointments have not yet been made.

PENNSYLVANIA's program also operates by executive direction. On August 12 Governor Duff appointed Richard K. Mellon, Pittsburgh financier, as head of Pennsylvania's internal security and civil defense program. Mellon, a Brigadier General in the National Guard, will undertake military as well as civil defense responsibilities in this assignment.

MIDWEST STATES

ILLINOIS. Major Lenox R. Lohr was appointed state director on August 14. A ten-member advisory council has been

created to prepare legislation giving state and mayors emergency powers. Governor Adlai E. Stevenson has authorized the formation of a reserve militia with peak strength of 15,000.

Chicago's defense organization, formed in June, is preparing for the exercises planned by the NSRB to test Chicago's defenses. It will take place September 11. Fire Chief Anthony Mullaney and Victor C. P. Dreiske head the organization, whose form follows that of the departments of city government. An organizational chart was issued on August 9. In preparation for the tests surveys are now being made of manpower, material, and hospital beds available to meet attack. Welfare committees completed a program for feeding, clothing, and sheltering fugitives at 200 assembly points. The mayor reported that city employees were being screened to eliminate poor security risks and that plans were being made to guard against sabotage of vital public installations. A plan for tatooing blood-type symbols underneath all citizens' arms to aid in mass transfusions has been completed.

INDIANA. A civil defense law was passed in 1949 and tentative plans have been made for air defense; county heads have been appointed, and industrial plants advised to tighten security guards.

IOWA has no new legislation and no new plan. American Legion members meeting in Sioux City early in August agreed to set up a civil defense establishment within a few weeks. The draft of a bill on civil defense has been prepared to be considered by the legislature next January. An air-raid warning net in Northeast Iowa is the main civil defense organization now in operation.

KANSAS. Legislation was passed last year, but there is little activity in civil defense. Former state guard officials have offered services if the state guard is organized again to replace the national guard.

KENTUCKY. There has been no legislation. Plans are said to be ready for civilian home mobilization if necessary; the defense director has power to call on state police, health, and other officials for help. The state law provides for 2,000-man state guard if the national guard is called up. Several cities have completed their own plans.

MICHIGAN's program operates under World War II legislation. Governor Williams has organized a civil defense council with advisory committees on public works, communications, utilities, etc. Fifteen hundred plane spotters are being selected. Sixty-one towns and cities over 10,000 have their own civil defense set-up under the state police commissioner, who is director of Michigan's defense.

Detroit's Disaster Committee has been functioning for over a year and claims to be prepared against natural disasters, but not organized to cope with atomic attack.

MINNESOTA has an executive plan. Seven thousand plane spotters are being recruited around the Duluth-Superior shipping area. Doctors from five states—Minnesota, North Dakota, South Dakota, Iowa, and Wisconsin—met in Minneapolis recently and announced plans for a "mutual assistance disaster program" for exchange of plasma and whole blood in case of an atomic bombing.

MISSOURI has no civil defense legislation. Governor Forrest Smith recently announced plans for reviving the Defense Council which operated in the last war. The state is reported working with the State Red Cross to set up evacuation areas within 120-mile radius of St. Louis and Kansas City, and a survey is under way on food and water supplies, transportation, etc.

NEBRASKA's civil defense legislation was passed last year. Governor Val Peterson recently appointed a state chairman to coordinate activities already under way in several cities.

OHIO passed legislation in 1949. The adjutant general is in charge of civil defense.

NORTH DAKOTA has no legislation and no plan. Two transcontinental railroads are said to be the only conceivable military objective.

SOUTH DAKOTA passed a law last year and has done some preliminary planning. As of July 23 South Dakota was still without a civil defense director.

WISCONSIN has no civil defense legislation and no plan. Some cities have local organization. Milwaukee's plan has been sent to mayors of other cities for help in their planning.

WESTERN STATES

The Rocky Mountain states are only in the initial stages of planning. COLORADO, UTAH, NEVADA, WYOMING, MONTANA, IDAHO, ARIZONA, and NEW MEXICO have passed no new legislation—all of them place authority in the office of the adjutant general. Nevada and Idaho still have World War II legislation. Idaho has no director. Aside from the disaster teams of police and fire departments in major cities, only the region's hospitals and civilian medical men have skeleton organizations ready for an emergency.

UTAH has recently appointed a seventeen-man state civil defense council which held its initial meeting on August 11.

NEW MEXICO expects its civil defense organization to be complete by September 1 (the deadline was moved up six months at the outbreak of the Korean War). Brigadier General Sage, the state adjutant, is director, and the plan will be operated by the State National Guard.

ARIZONA has recently appointed Maj. Gen. Alexander M. Tuthill as state director of civil defense.

WEST COAST STATES

WASHINGTON and OREGON passed civil defense legislation in 1949 and placed civil defense planning under civilian directors. CALIFORNIA's defense system is organized under World War II legislation, with its program in the hands of the State Disaster Council. A two-day conference on civil defense was held by the West Coast Mayors Association in June. During the meeting the Federal Government was criticized by Mayor Robinson of San Francisco for "keeping municipalities completely in the dark" about specific measures to be taken in the event of atomic attack, and there were appeals by the mayors for strong federal leadership. On July 21 the Board of Directors of the League of California Cities announced that no local preparations against atomic attack could be made pending federal assistance. However, progress in planning has been announced since then by both *Los Angeles* and *San Francisco*. Mayor Bowron of Los Angeles issued to the citizens of Los Angeles a list of seventeen things to do before an expected atomic attack and immediately afterward. The city of San Francisco appointed a full-time director of civil defense, taking $100,000 from its emergency funds for civil defense purposes and earmarking $10,000 for the salary of this director. The new director of the city's Disaster Council is Rear Adm. Albert C. Cook. According to the *New York Times* of August 13,

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EASING CONTROLS OVER INDUSTRIAL DEVELOPMENT—A COMMENT ON THE LILIENTHAL PROPOSALS

Byron S. Miller

Mr. David E. Lilienthal's recent proposals, published in "Collier's" magazine, to develop atomic energy "as we normally would any new industrial knowledge: through private industry and competition," are challenged in the following article by a Chicago lawyer. Mr. Miller, co-author of "The Control of Atomic Energy," served as Associate General Counsel of the Office of War Mobilization and Reconstruction, the agency which acted for the administration in securing domestic atomic energy legislation.

SHIBBOLETHS as a medium for political discourse have rarely been as enthusiastically embraced as in a recent series of two articles appearing in *Collier's* magazine (June 17 and July 15, 1950) over the pen of David E. Lilienthal, former Chairman of the U.S. Atomic Energy Commission.

Mr. Lilienthal's thesis, presented in terms of "Government Monopoly" *versus* "Competitive American Industry," is that if private industry were free to work on the civilian uses of atomic energy for private profit, development of these uses would come more rapidly than under the present scope of government regulation.

The desirability of more rapid development of industrial uses is almost universally accepted. And we may accept Mr. Lilienthal's conclusion that industry's present interest in the field is adversely affected by AEC powers and public attitudes toward atomic energy. The questions presented by Mr. Lilienthal's articles, however, are:

1. Are supplies of basic materials sufficient to permit the degree of competitive private activity he urges?

2. Are the changes he proposes likely to result in the investment and participation by industry, which he projects?

3. Does the possibility of quicker development of civilian uses warrant the reduction in effective government control of atomic energy and the possibility of atomic power monopolies which also would follow from the Lilienthal proposals?

Mr. Lilienthal is so much the advocate that his presentation obscures many of the basic factors and relevant issues. Hence, the purpose of this article is to lay a basis for a more objective appraisal of his principal proposal within the limitations of available information. Certainly, a recommendation for major changes in the Atomic Energy Act by its first chief administrator is worthy of most careful consideration.

At the outset it seems desirable to segregate a number of Mr. Lilienthal's specific recommendations which are not necessarily linked with or essential to the validity of his main argument. Hence, placing these recommendations in better perspective will enable the reader to view the main issue more distinctly.

1. *Secrecy.*—Mr. Lilienthal argues for limiting the secrecy concept to military matters, as is done in the case of restrictions applied to radar, guided missiles, and the like. His argument that elimination of this barrier is essential before private industry can fully participate in industrial atomic development is unquestionably valid. But it is also true that governmental development is similarly retarded by wide notions of secrecy which were plausible, at best, before Russia developed its own atomic bomb. This recommendation, then, is worthy of adoption on its own merits regardless of the outcome of his main proposal.

2. *Industrial access to production processes.*—Mr. Lilienthal argues the importance of permitting many private firms to study our processes for producing fissionable material with a view to developing improvements in these processes. Adoption of this suggestion, however, does not require legislative action, and its desirability is not dependent upon private development of the "industrial atom." The AEC now has power not only to permit many private firms to examine presently operating reactors, but may subsidize the expense involved in such examination and subsequent research and development on improved processes and equipment. It is probably true, however, that industry's interest in such a role may be affected by the scope of atomic activities permitted it.

3. *Leasing existing production plants.*—Mr. Lilienthal suggests that government-owned plants for the production of fissionable material, now operated by private firms under contract, be leased to them instead. The distinction eludes the writer; either relationship appears to supply the same incentive to industry and the same practical effect. Under management contract or lease, AEC will own the plant and receive all the fissionable material produced; the private firm will run the plant and receive a set compensation, and the degree of AEC supervision will be spelled out between them, whether the fine print appears in a document labeled "lease" or "operating contract."

4. *Research Reactors.*—In suggesting three areas for private industrial development, Mr. Lilienthal lists as his second recommendation a research reactor for exposing various materials to the intense radiation of a pile. As a private investment the construction of a reactor for this purpose alone would not seem warranted unless the service could be sold in sufficient volume to retire the investment. Such a service is valuable for two purposes—to test materials for their suitability in a reactor, and to conduct fundamental research with no clearly defined or immediate practical application. Neither of these seems sufficiently sizable to support private investment in such a

The author is indebted to Dr. John A. Simpson, Associate Professor of Physics at the University of Chicago, for much of the technical material incorporated in the article.

reactor. In addition, AEC currently could offer such an irradiation service, and its facilities would seem adequate for most purposes. One of the four new experimental reactors now being developed by AEC is designed primarily for testing the effect of such irradiation on materials.

5. *Isotope Production.*—As another area for private industrial development, Mr. Lilienthal suggests the construction of a reactor for the production of radioactive isotopes. Such isotopes are presently produced in abundance by AEC[1] and sold where customers can be found. Mr. Lilienthal's oblique references to the "government price scale" and the desirability of competition obscure the fact that AEC prices are computed on a special basis. In setting AEC prices it is assumed that its reactor would be operating anyway (for research purposes) and the price need only return the special expenditures incident to the irradiation, separation, and special handling of the isotopes, a small fraction of the cost of building and operating the reactor. A private firm building a reactor solely for the purpose of producing isotopes for sale would have to amortize the reactor cost, and no conceivable improvement could bring it down to the zero cost necessary to meet the AEC price level.

* * *

These propositions aside, Mr. Lilienthal's chief thesis is that the nation will have atomic power more quickly if private industry is permitted to invest its own funds and build such power reactors competitively for private profit.

The reading public, to whom these articles were directed, would gather from Mr. Lilienthal's presentation that the development of atomic power is an imminent possibility, delayed and prevented by the present system of atomic energy control. Yet every study of the subject available to the writer, including public statements by the AEC General Advisory Committee and AEC's Director of Reactor Development, emphasizes these basic facts:

(1) that no power-producing reactor has yet been built;

(2) that major engineering difficulties in regard to materials and design have yet to be solved;

(3) that even a modest commercial power reactor is not likely for some five to eight years; and

(4) that atomic power will not become competitive with coal, oil, or hydro-produced power in 20 to 30 years, if ever.[2]

Hence, the sense of urgency which pervades the Lilienthal proposals does not appear to have any foundation in fact.

Even if these proposals presented a more immediate question, there are a number of weaknesses on the merits which bear more careful scrutiny. Before exploring what industry has to offer and whether industry is likely to respond to this proposal, let us first inquire whether quantities of essential materials are available to make the proposal possible.

ATOMIC AND SOURCE MATERIALS

From information presently available, it appears that even initial power reactors must be fairly substantial in size and must utilize a sizable quantity of atomic material. AEC is now building at least two such reactors. The first question, therefore, is whether the United States has sufficient atomic material available to invest in any significant number of competitively-built power reactors.

How much atomic material we have or will have is of course classified information. But apparently we continue to engage in extensive diplomatic relations to import source materials into the United States. So long as this is the case, careful husbanding of these materials and of the ultimate atomic materials is required. Whether and over what period they can be made available for a number of power reactors is a question Mr. Lilienthal does not discuss.

In view of his access to this confidential information, however, perhaps we may assume that Mr. Lilienthal feels this problem can be met. On the other hand, AEC in its Third Semiannual Report referred to supplies of atomic materials as among the problems which "introduce a time factor measured in years into any discussion as to when nuclear energy can make a significant contribution to the supply of power now available from other sources".

And both projections leave untouched the question whether making these materials available for competitive industrial development raises borderline policy questions which warrant public discussion.

Assuming that some materials are available for this purpose, the next question is whether, if the Lilienthal proposals were adopted, industry would in fact invest its own funds in the construction of private power reactors. This question has two facets—the kind of regulation industry would continue to face even under the Lilienthal modifications and the financial factors involved in industry's decision on this point.

INEVITABLE DEGREE OF GOVERNMENT CONTROL

Mr. Lilienthal places great stress on the present scope of government control as an important practical and psychological barrier to the willingness of industry to experiment in this field. Under the Act in its present form, a private firm is not permitted to build a large private reactor (Section 4); and elimination of this restriction is urged. Mr. Lilienthal urges a new "climate for private enterprise," suggesting a reduction in the controls of industrial uses now contemplated in Section 7 of the Act.

Would these changes give industry the freedom from government regulation which presently restrains private efforts? Since the Lilienthal articles do not consider the probable minimum controls applicable to this very special field, a fuller statement of the kinds of government control and supervision likely under any foreseeable modification of the Act seems warranted.

Throughout the discussions on international control of atomic energy has run the theme that a large-scale reactor for civilian use is always capable of conversion to production of bomb material. Atomic materials are not so plentiful as to permit their wholly unrestricted use. What minimum degree of regulation must industry accept in this field, unlike any other area of industrial endeavor? It may be summarized as follows:

1. *Atomic material.*—Even assuming there were sufficient atomic material available to warrant the supplying of a number of private reactors, AEC will inevitably be exercising regulatory powers in the supplying of the material. Thus, the quantity available at any time may be drastically affected by changing estimates of military needs. This is perhaps similar to the situation facing industries dependent on steel, copper, and other materials allocated in wartime, but the probability and extent of

[1] See, for example, *Isotopes – A Three-Year Summary*. By AEC. Washington: Government Printing office, 1949. $.45.

[2] Lawrence H. Hafstad, "Problems in the Application of Atomic Energy." Speech before the Society of Automotive Engineers, Detroit, Michigan, May 23, 1950; Walter Isard and Vincent Whitney, "Atomic Power and the Location of Industry," *Harvard Business Review* XXVIII (March 1950), 45-54; and Philip Sporn, "Prospects in Industrial Application of Atomic Energy." Address given at the annual convention of the National Coal Association, New York, October 7, 1949.

military demands is greater with respect to atomic materials.

Then, the AEC may agree to furnish material to six reactors in 1956, but decide in 1959 that A Company's reactor is so inefficient compared to the others that materials are better supplied to a new reactor of different design. In such an event A Company would be left high and dry, not by the automatic processes of supply and demand, but by government decision. That such an occurrence is possible is apparent from the action of the Manhattan Project in beginning the construction of a thermal diffusion plant, spending considerable amounts of money on it, and then abandoning it because alternative designs also under construction proved worthier.

This type of risk is peculiar to the atomic energy field. Designers of water-power machinery face no real risk of loss of access to rivers and dams; designers of oil-burning or coal-burning equipment for power production need not fear loss of oil or coal; but designers of atomic power machinery have a continuing and special risk that atomic fuel supplies will be cut off.

2. *Location and type of reactor.*—Any private firm building a power reactor would be obliged to obtain its original and perhaps replacement atomic material from the AEC. If AEC is thus to give its blessing to private reactors, it is most likely that AEC will want certain governmental objectives served by the location and type of the reactor. Thus, AEC will probably not want too many in a single area; it may establish a preference for inland rather than coastal locations; it may establish a policy concerning proximity to other sources of power, etc. Perhaps in most cases agreement can be reached on a "compromise" location, but this too is not the same as an unfettered choice.

Or AEC may not want to permit commitment of its atomic material to a reactor whose design does not permit withdrawal of the material at any time or which does not breed additional material. Such restrictions may increase the investment required and rule out entire areas of possible development.

3. *Safety inspection.*—AEC inspectors must either be stationed at, or have access to, all privately-owned reactors. This is necessary to assure safe handling of radioactive materials, to protect the community from radioactivity hazards, to prevent unintentional accumulation of explosive quantities, and to guarantee no diversion of atomic materials. Of itself, this may be no more than an extra nuisance to be borne by the company, but to the extent that secret non-patented processes may be developed, the private firm will be subjected to a possible extra avenue of disclosure.

Mr. Lilienthal vigorously attacks Section 7 of the Act which authorizes the Commission to regulate civilian uses unless Congress, within a specified period, amends the Act to restrict the regulatory power. The alternative would be no regulatory power unless and until Congress supplies it at a later date, since everyone is agreed that today's knowledge is inadequate as a basis for specifying tightly limited regulatory powers.

It is submitted that Mr. Lilienthal's presentation is distorted. From his account it would appear that competing industries are given a special opportunity to repress atomic developments which may affect their revenues. Exactly the opposite is the case.

Suppose, for example, that atomic power were a practical reality today and there were no Section 7 in the Act. Assuming no obstacles from other sections of the Act, a private atomic power industry could operate without regulation. Efforts to regulate it would begin in the halls of Congress, sparked by competing industries with long-demonstrated political effectiveness, and the result might well be a statute with crippling effect. Under Section 7, however, the AEC with a special reason for fostering an atomic power industry would prepare a regulation and, unless Congress were able to amend the law to kill the regulation within ninety days, the regulation would go into effect.

Anyone with experience on Capitol Hill will verify the comment that it is far easier to block a piece of legislation than to obtain its enactment. And this reality is reflected in Section 7 by giving Congress a chance to review a new development never before presented for its consideration but enabling AEC to proceed if Congress is unable to act promptly. This principle is also recognized by the form of the executive branch reorganization laws consistently sought by the President—the plans take effect unless Congress vetoes them, rather than waiting for Congress to approve them.

FINANCIAL FACTORS

Mr. Lilienthal includes, as the other ingredient for creating a "climate for private enterprise," anticipation that the reactor will be operated for private profit, amendment of the patent provisions of the Act, and allowance of special tax deductions for investments in reactors.

The economics of power reactors, none of which has yet been operated, has been the subject of conflicting predictions. A variety of different types of reactors has been proposed, each with its special bases for projecting construction and operating costs.

Without digressing into these projections, we may focus upon a few broad factors on which industry would be likely to rely.

First, as Mr. Lilienthal suggests, we may assume that some of the larger industrial firms would be interested in building power reactors as risk ventures if valuable patent rights would be available and if original estimates were not wildly unfavorable as compared to costs of producing power from other sources.

Estimates of the costs of operating atomic power reactors, while sharply divergent, all seem to anticipate that, for the near future, atomic power operations will be more expensive than coal-derived power operations (except that in some sections of the country, atomic power may be cheaper for certain special purposes).

There seems sufficient possibility that the gap would not be so large, however, that operating improvements might not narrow or overcome it. Hence, operating costs are not likely to be a complete deterrent to private investment in this field.

Estimates with regard to comparative capital cost of constructing the reactor vary with the design and, in any case, amount to huge sums of money. This means that private development will be limited to the largest firms. Available analyses indicate that nuclear reactors will require a capital outlay substantially larger than is needed for power plants using conventional fuels. However, once constructed, the costs of operation are likely to be far more stable than costs which change with fluctuations in the price of coal, oil, or gas. No conclusion can yet be reached as to the relative importance of these factors, so the possibility of private construction of power reactors cannot be ruled out on this score.

The source, cost, and quantity of atomic material needed, however, will probably have an important effect on the likelihood of private investment in this field. The initial quantity with which to put the reactor in operation must come from AEC. Will AEC contribute this material on the ground that the capital investment being made by industry saves the government expenditures it would otherwise have to make? If so, it constitutes a significant governmental subsidy; if not, any realistic cost figure would materially in-

crease the private capital required, possibly becoming the determining factor for non-investment by industry.

Secondly, what will industry do with the atomic material it produces incident to its power production? If it is a reactor which produces less than replacement needs, then the atomic material cost question just presented continues throughout the life of the reactor. If it produces substantially its needs, it will still require that the material be processed in government plants in order to be used as replacement materiel. (Construction of private processing plants, at least for some time to come, would seem to be prohibitively expensive.) Would the government supply this processing as a subsidy or would it exchange processed material for the industry product at a realistic service charge?

These factors are mentioned briefly, not as a basis for predicting industry's willingness, but to indicate that even on the economic level, government policies and perhaps subsidies will continue to affect industry's participation even with the legislative changes Mr. Lilienthal proposes.

From the foregoing—the high capital investment required, the likelihood of higher initial operating costs, the possible need for government subsidies with regard to atomic material—it appears that private industry may not build power reactors even if permitted unless some further economic incentive is supplied. This Mr. Lilienthal proposes through modification of the patent provisions of the Act.

As presently written, the Act permits private patents on atomic reactors, subject to several provisions not generally applicable in the patent field. These are:

1. No patent can cover inventions of processes or equipment for the production of atomic material;

2. The patentee must license its use in return for a "reasonable royalty"—no monopoly of use or suppression is permitted;

3. In determining what is a "reasonable royalty," AEC must take into account federal subsidies of the work which yielded the invention; and

4. AEC has power to take over the patent without the patentee's consent for "fair compensation" similarly determined.

Two problems are posed by these provisions. First, does the fact that production processes and equipment cannot be patented rule out any financial return or achievement of preferred position as a result of the risk venture in building the power reactor? (Whether there are more important public needs served by the present provision is discussed below.) No guarantee can be given except to recognize: (a) that the broader the patent rights available, the more attractive they are; and (b) that many power reactor inventions are likely to be considered "production process" discoveries. Hence, the present area closed to patents does seem to eliminate a valuable incentive.

Secondly, assuming the patent available, other provisions prevent its exclusive use and regulate royalties. Here, too, the private developer would get less than he might if these provisions were absent. Permitting exclusive use by the private firm holding the patent would be a major, if not the major, factor in determining whether risk ventures in this field would be worth while. And unregulated royalties would, of course, be more lucrative than regulated ones. On the other hand, if industry achieves the patent by virtue of government grants, unregulated royalties are just one more way of subsidizing the participation of industry.

With regard to the effect of economic factors upon incentive, then, it appears that government policies on the price of atomic materials supplied to industry, on charges for processing the material required by industry, and on overlooking subsidies in permitting unregulated royalties will continue to be major factors even if industry is permitted to build private power reactors.

OTHER CONSEQUENCES

The foregoing discussion has been devoted to a careful review of the factors affecting industrial participation under the Lilienthal proposal—a review of inevitable controls peculiar to the atomic energy field and of the economic factors confronting industry.

Assuming that industry wishes to undertake the construction and private operation of power reactors and that the Lilienthal proposals were adopted, what are the other consequences of these changes?

The Lilienthal proposals would authorize the private construction, ownership, and operation of reactors capable of producing bomb quantities of atomic material. Private firms would be permitted to own their own atomic material in quantities large enough for power purposes which, according to U.S. statements on international controls, may be bomb-size quantities. Patent controls would be changed to parallel general patent law.

In short, Lilienthal recommends abandonment of the exclusive government ownership of facilities and materials capable of bomb production. He assumes, however, that the military aspects of the "industrial atom" will continue to be subject to regulation.

This presents squarely the issue whether *government ownership* or *government regulation* supplies the more desirable technique of control.

The U.S. plan for international control rested squarely on a preference for *ownership* through an international authority as against national sovereignty subject to regulation and inspection. International control is something less than a live issue at the moment, but do not the same principles apply to domestic control?

Secondly, abandonment of present patent provisions, as Mr. Lilienthal suggests, would make possible the creation of private atomic power monopolies or pools based on key patents. The unknown factors in power reactor construction and operation which make cost estimation difficult also promise that there will be significant new discoveries, which, under the Lilienthal proposal, could be locked up under patent.

Thirdly, removing royalty restrictions in the present Act would enable industry to receive a substantial return on discoveries made possible only by government expenditures for subsidized research.

* * *

The Lilienthal proposals would trade a reduction in effectiveness of government control of atomic energy, giving authorization to industry to invest in the hope of obtaining an atomic power monopoly, and make one or two other changes in exchange for private investment in the construction and operation of atomic power reactors at some indefinite future time.

With regard to patent changes which would permit exclusive use by the patentee and thereby envisage a patent monopoly in this field, such exclusive use would seem to be diametrically opposed to the entire purpose of the proposed amendments — getting more firms to build and operate power reactors.

If industry would participate under present patent restrictions, then the principal question would be whether abandonment of the present system of government ownership is warranted by the quicker development Mr. Lilienthal expects from the participation of private industry on its own funds. In so far as this conclusion flows from Mr. Lilienthal's conviction that development occurs more rapidly under private in-

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UNESCO AND INTERNATIONAL SCIENTIFIC ORGANIZATION

Wang Ging-Hsi

An over-all report on the current activities of the Natural Sciences Department of the United Nations Educational, Scientific, and Cultural Organization was given by Dr. Frank J. Malina in an article published in the Bulletin in April 1950. The present article, prepared by the Head of Unesco's Division of Scientific Organizations, describes the efforts of this Division to promote world scientific collaboration through aid to new and established international scientific groups.

ACCORDING to its constitution, Unesco aims to "maintain, increase, and diffuse knowledge" by (1) conserving the world's inheritance of books, works of art, and historical monuments, (2) encouraging cooperation among the nations in all branches of intellectual activity, and (3) "by initiating methods of international cooperation calculated to give the people of all countries access to the printed and published materials produced by any one of them."

In order to carry out its work in the field of the natural sciences, Unesco must cooperate closely with scientists active in research and teaching throughout the world. Since specialists in every branch of the natural sciences cannot be included in the Unesco staff, Unesco must collaborate with international organizations established by these scientists.

The relations between Unesco and the international non-governmental scientific organizations are of the nature of a cooperative alliance. Each year, these organizations propose a number of projects; Unesco allocates grants-in-aid to those that fall within its own program. The scientific organizations not only carry out the projects, but also advise Unesco on its projects in science by making reports on specific scientific subjects and by acting as consultants for the Unesco Field Science Cooperation Offices in scientifically underdeveloped countries.

Before describing the cooperation maintained during the past three-and-a-half years, it may be useful to trace the development of international cooperation in the natural sciences.

HISTORICAL DEVELOPMENT OF INTERNATIONAL COOPERATION IN THE NATURAL SCIENCES

The grand international congresses of different disciplines in the natural sciences began after 1850. These large-scale congresses have been open to all scientists in their respective fields and have provided opportunities for exchange of information. The congresses usually meet every three or four years and have a permanent committee to carry on the work in the interim.

Paralleling this development, was the growth of two kinds of permanent agencies for international cooperation —inter-governmental and non-governmental. An example of the inter-governmental form of cooperation is the Bureau International des Poids et Mesures. In 1872, the International Meteorological Office was organized; it recently became the World Meteorological Organization, a new specialized agency of the U.N. International non-governmental organizations were often established by the international congresses, for example, the international commission on the map of the heavens established by astronomers in 1887, and the International Commission on Zoological Nomenclature, in 1895.

The International Research Council was a more comprehensive form of organization which developed from these non-governmental agencies in 1919. In 1931, this council became the International Council of Scientific Unions (ICSU). Within the two years, 1918-1921, eight new international unions were formed which were included later in ICSU. These unions serve as connecting links between the periodic general congresses and as coordinators of permanent commissions. ICSU has proved to be a flexible organization. Unions which are dissolved may withdraw from the group and new unions may be admitted without causing a fundamental change in the Council itself. The Council has established a number of joint commissions, in which two or more unions participate, and because the border-line fields between divisions of science are the most fertile regions for research, these joint commissions have increased in recent years.

There have been three recent tendencies in the development of international cooperation in natural science: (1) As the number of specialists increases, the large congress becomes unwieldy, and scientists have adopted the procedure of organizing a symposium or colloquium at which a limited number of specialists are invited to exchange ideas; (2) Three newly formed unions are composed of both individual scientists elected directly by their General Assemblies and delegates chosen through the national commissions of the adhering countries; (3) Because the functions of the organizations have increased in scope and range, it has become necessary to have full-time paid executive secretaries.

UNESCO'S CONTRIBUTION TO THE INTERNATIONAL ORGANIZATION OF SCIENCE

In December 1946, Unesco signed a formal agreement with ICSU. Unesco has been interested in aiding existing unions and in helping to establish new ones, for example, an International Union of the Physiological Sciences, an International Union of Geology, and an International Council for Engineering Sciences. In cooperation with the World Health Organization, Unesco partici-

pated in the formation of the Council for the Coordination of International Congresses of Medical Sciences.

In the basic sciences, Unesco allocated in 1947, grants-in-aid totaling $256,130 to ICSU and the unions it federates and to three other international scientific organizations (International Physiological Congress Committee, International Congress of Mental Health, and World Federation of Scientific Workers). In 1948 and 1949, the totals were $238,374 and $256,425, respectively. In 1950, the appropriation in Unesco's budget for grants-in-aid had been $200,000, but was reduced to $185,000 because of the devaluation of the currency in many member-states. The following two tables show the distribution of the four years' grants-in-aid according to different major divisions of basic sciences and according to the criteria for the allocation of the grants-in-aid approved at the Third Session of the General Conference at Beirut in 1948.

TABLE 1

DISTRIBUTION OF UNESCO GRANTS-IN-AID AMONG MAJOR DIVISIONS OF BASIC SCIENCES

Division	Percentage of Budget 1947	1948	1949	1950
General sciences (including the History of science)	17.8	18.1	24.5	25.20
Physico-chemical sciences	25.9	22.7	37.4	27.78
Astronomy and earth sciences	17.4	25.3	18.2	21.21
Biological sciences	36.9	33.9	19.9	25.81
Medical sciences	2.0	.....	.....	.....

TABLE 2

ALLOCATION OF UNESCO GRANTS-IN-AID

	(In thousands of dollars) 1947	1948	1949	1950
A. Transportation expenses for meetings of Symposia, Commissions, etc.	34.1	39.0	50.9	46.9
B. Transportation expenses for meetings of General Congresses and General Assemblies	46.8	44.0	20.7	5.5
C. Travel grants	17.0	10.4	11.0	11.0
D. Publications	47.1	52.9	89.6	47.2
E. 1. Permanent international services	47.3	40.5	20.3	17.7
2. International Laboratories and stockrooms	47.2	40.4	47.7	34.4
F. Administrative expenses to ICSU for administering the grants-in-aid	12.1	11.0	16.0	14.2

Besides these grants-in-aid, Unesco granted in 1948, $20,000 to the Seventh Pacific Science Congress held in New Zealand in February 1949, to be used to invite selected participants from war-devastated countries in Asia and from certain European countries which have done research work on the subject of the Pacific Ocean. The Congress was authorized to use the residue of the grant ($5,600) for establishing a permanent Secretariat at Honolulu, Hawaii.

In 1950, Unesco allocated a subvention of $10,000 to the Organizing Committee of the International Congress of Mathematicians, to be held at Cambridge, Massachusetts in September 1950, for inviting selected participants from countries outside the USA; and another $10,000 to the Policy Committee of the American Mathematical Society, the Institute of Mathematical Statistics, the Association for Symbolic Logic, and the Mathematical Association of America, for inviting prominent mathematicians from countries outside the USA to attend a meeting at New York City in August 1950 to re-establish the International Mathematical Union.

In 1949, Unesco concluded two contracts with the International Union for the Protection of Nature by which the Union undertook the scientific preparation of the joint Unesco-IUPN International Technical Conference on the Protection of Nature, held at Lake Success, in August 1949. A third contract, entrusting the IUPN with the editing and printing of the Lake Success Proceedings, brought Unesco's financial assistance to the Union for the two years to a total of $13,700. This year, Unesco has already given the Union $8,500 for specific program projects.

In the medical sciences, Unesco in 1948 gave financial aid totaling $6,000 under contract to three organizations: the Permanent International Commission on Industrial Medicine, the International Union against Cancer, and the World Federation for Mental Health. In 1949, Unesco and WHO together called a Conference at Brussels which set up the Council for the Coordination of International Congresses of Medical Sciences, which soon after received a grant of $5,000 from Unesco, as help toward the publication costs of the proceedings of seven different international medical conferences.

The General Conference of Unesco in its fourth session approved a budget of $23,800 as Unesco's contribution to the CCICMS during 1950, WHO granting slightly less than twice this amount to the Council for the same period. Up to May 1, $9,000 was allocated for publication costs of the following international congresses: Radiology, Psychiatry, Ophthalmology, etc.

Unesco is also helping the international non-governmental organizations concerned with engineering sciences. In 1949 the World Power Conference was granted $2,400 to help with the re-issue of the *Statistical Year-Book* whose publication had been interrupted by the war. The International Society of Soil Mechanics and Foundations Engineering received $3,000 to publish the seven volumes of Proceedings of the Second Conference, held in Rotterdam in 1948. In 1949, Unesco also concluded a contract with the International Commission on Large Dams of the World Power Conference for the publication of an illustrated multilingual dictionary on Large Dams. For 1950 Unesco put $1,000 at the disposal of the World Power Conference to aid a limited number of participants to attend the Fourth World Power Conference, which took place in London, in July.

TABLE 3

WORK OF ICSU, 1947–50

	1947	1948	1949
Symposia	4	13	8
Commission meetings	36	18	6
General Congresses	3	3	0
General Assemblies	3	5	3
Travel grants	13	19	12
Publications			
1. Reports	23	63	42
2. Monographs	11	19	4
3. Periodicals	7	9	11
Permanent services	13	12	20
Laboratories & stockrooms	19	22	22
Number of scientists assisted financially to attend meetings of Symposia, Commissions, General Congresses, and General Assemblies	324	442	280

During the three years from 1947 through 1949, ICSU, its unions and their subsidiary organizations greatly contributed to international cooperation in the natural sciences. The result of their work is summarized in Table 3.

An example of Unesco's assistance to an international symposium is the grant given to the Symposium on Motions of Gaseous Masses of Cosmic Dimensions which was organized jointly by the International Astronomical Union and the International Union of Theoretical and Applied Mechanics. In this Symposium, which was held in Paris in 1949, fifty-one scientists from eleven countries participated. At this meeting, hydrodynamists and astrophysicists were able to meet on common ground for the first time. As an example of the work done at the meetings of the Commission of or Unions of ICSU, we may cite the first meeting of the Joint Commission on the Ionosphere which was held at Brussels in 1948. The meeting reviewed the existing knowledge on the ionosphere, pointed out problems for further research, and planned cooperation in research on the international level. In 1948, with a grant of $4,000, the Organizing Committee of the Eighth International Genetics Congress, which met at Stockholm, was enabled to defray partially the transportation expenses of twenty geneticists from eleven countries, including one each from China and Japan. The Bureau International de l'Heure is an example of an international permanent scientific service which has received support from Unesco.

CONCLUSIONS

Many of the international non-governmental scientific organizations have been criticized for being Europe-centered. This is not strange, since modern science originated and was mainly developed in Europe. Only in the past seventy-five years has modern science spread to other continents. Furthermore, many international non-governmental scientific organizations cannot afford to have active members from countries outside Europe on their executive committees and commissions, because of lack of available funds to defray their traveling expenses. Unesco's support has lessened this financial obstacle. ICSU and its unions have really acquired a world-wide basis. For instance, the Commission on Cosmic Rays in the International Union of Pure and Applied Physics has Dr. Anderson of USA, Professor Bhabha of India, and Professor Vallarta of Mexico, as members.

Unesco's grants-in-aid have hastened the postwar resumption of international cooperation in the field of the natural sciences. Even now, scientists in most countries find it exceedingly difficult to obtain traveling expenses either to attend international meetings or to work for a short period in other countries. Some international services were without adequate funds; some international laboratories and stockrooms were in need of essential equipment. Unesco's grants-in-aid to the international non-governmental organizations for 1947 arrived in time to meet these urgent needs and facilitate the revival of international cooperation in the natural sciences.

Before the war, ICSU and the unions it federates were able to carry on their work with their limited means. The support which Unesco has given them since 1947 has made it possible for them to enlarge the scope and range of their work. Thus, ICSU and its unions on the one hand, and Unesco on the other, have benefited from the close cooperation ensured by the Formal Agreement signed in December 1946. Unesco has, through its grants-in-aid to ICSU and its unions, achieved its function to "maintain, increase, and diffuse knowledge" in the natural sciences.

ACKNOWLEDGEMENT

The Bulletin wishes to thank the editor of Le Monde for permission to translate and publish the articles by Professor Etienne Gilson which appeared in the July Bulletin. The credit line which should have accompanied the article was inadvertently omitted.

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Hirschfelder: Effects of Atomic Weapons

(Continued from page 240)

well covered up or in dustproof containers. There is need for realistic standards of safe amounts of alpha, beta, and gamma emitting contamination in food and water. Present standards are based on the smallest amount of contamination which could conceivably hurt you if all of the food and water you consumed every day of your life had a definite amount of contamination. In time of emergency and for limited periods, you could consume food and water with a thousand times the peacetime tolerance. For example, a large number of people drink radioactive mineral water for their health, although this water greatly exceeds our present tolerance.

CIVILIAN DEFENSE

In planning the civilian defense of a city it is important to keep a proper

sense of perspective. To disperse a large proportion of the urban populations or to move all strategic industries underground within a few years would be economic suicide. There are many very important civilian defense measures which do not require the outlay of large amounts of money. Most of the problems are the same, regardless of whether protection is sought from conventional bombing raids or from atomic bombing. Many of the steps which would reduce the dangers from bombing would also help to provide better living in the city:

1. Remove the foci of danger, such as slum areas with their tinder box construction and fire hazards.

2. Provide good highways and arteries of transportation into the heart of the cities to serve as firebreaks and good escape routes.

3. Build parks and thereby reduce the density of population. People in cities with less than 100,000 should be relatively safe, since atomic bombs are expensive weapons and must be reserved for large metropolitan areas or primary targets.

Byron S. Miller: Lilienthal Proposals

(Continued from page 282)

dustrial auspices than under government auspices, no purpose would here be served by exploring this almost doctrinal question. There is no way of knowing that atomic power will come more quickly under industrial ownership than under the present system of government-financed research in which private firms and many universities participate. So far as is known, slowness in developing power reactors to date is a function of incomplete research and the special facts that, unlike non-radioactive inventions, pilot model reactors cannot be built and large reactors cannot easily be tinkered with once in operation. If the obstacle is the non-participation of industry's "best brains," then the question is whether industry's price for its services is not too high—exclusive patent rights.

Careful review of the many factors outlined above may yield the conclusion that the incentive of monopoly patents should not be offered and that, without them, the time for investment by industry has not yet arrived. When the economics warrant industry's participation subject to compulsory licensing and reasonable royalties, then may be the time to shift from the present system of government ownership to one of government regulation.

Major Zeidler: Civil Defense Problems

(Continued from page 251)

time they have to reconstitute themselves.

For a number of reasons an assumption might be made that American cities have only months in which to formulate workable programs of defense and that most objectives must be considered from this short-range view.

Some factors of a psychological nature and a social nature must be considered in civil defense. I have mentioned before the unwillingness of people in cities to consider themselves as possible targets. Once they begin to realize that they are objects marked for destruction, there appears in many cities a kind of helplessness. Life in cities tends to regiment people and reduce their initiative. As a result, in many cities people wait for orders from the "authorities," while the "authorities" are waiting to see what the public wants. This tendency makes for inaction and accounts for the fact that only a few cities—and Milwaukee is one—have started a civil defense program.

Once the program starts and receives popular acceptance, competing political or social groups vie for leadership. Their rivalries, unless kept within bounds, can adversely affect the growth of civil protection.

The national and international aspects of governmental policies cannot be overlooked. An unpopular government cannot gain civil support. People living under a system which they feel exploits them or which calls for inequality of sacrifice are not likely to be enthusiastic in their defense of that system.

Broadening this concept, it is safe to conclude that every nation and every international group has its adherents in the United States. Their activities might conceivably affect the outcome of any conflict between this nation and other groups. It is essential, therefore, that our policies as a nation be so firmly based on righteousness and progressive principles that our system of government appears more desirable than any other.

THE IMPLEMENTATION OF THE MILWAUKEE PLAN

Since the Korean war, the Milwaukee Civil Defense and Disaster Committee has decided to fill out the framework of its construction.

Operating under the Director, who is the Mayor, are two deputy directors. One deputy handles six divisions concerned with administration. The other deputy heads eight divisions concerned with operations.

A rudimentary warning system has been set up; wardens have been recruited; a public information section has been expanded. Plant protection has been initiated; vital public facilities are being guarded; and certain phases of an evacuation plan have been initiated.

These activities have been started as a "dry-run," for in previous exercises of parts of our committee valuable lessons resulted.

We have initiated liaison with the state and other local governments and prepared legal studies necessary if local committees are to be given power to act.

By this process a number of blind spots in operation have been discovered, and the probable cost of a permanent set-up ascertained. The cost of structures such as control centers or shelters has not yet been determined, nor has the source of funds been found.

THE VITAL NEEDS FOR CITIES

How long must cities burden themselves with the problems of civil defense? My answer is *for an unforseeable length of time;* but cities can make their tasks lighter or heavier by directing their own growth to form the least possible target, and by regulating their normal lives so that the pattern of living conforms also to a pattern of protection and defense.

Planned decentralization and sturdy construction, combined with a system of shelters, should create a defense system which, of itself, could readily be absorbed into the framework of living.

Public education must include studies in self-protection for all persons, and a greater spread of technical knowledge. Trade instruction and training in the understanding and handling of machinery are vital.

Above all, defense must be built on a governmental system grounded in humanitarian concepts and in good will sufficient to attract world support. Under these conditions international crises will arise with less frequency, and the hope of a democratic federation of governments throughout the world may be maintained and ultimately realized.

NEWS IN BRIEF

AEC APPOINTMENTS AND RESIGNATIONS.—

Dr. T. Keith Glennan, President of the Case Institute of Technology, Cleveland, Ohio, was nominated by President Truman on August 11 as a member of the Atomic Energy Commission.

He will fill the vacancy caused by the resignation of Lewis L. Strauss in February.

Dr. Glennan has had considerable executive experience as operations manager and studio manager for two leading Hollywood motion picture companies and later as an executive for the General Aniline and Film Co. at Binghamton, New York. During the war he was Director of the Navy's underwater sound laboratory at Columbia University. He received the Medal of Merit for this service.

* * *

Three new members of the General Advisory Committee of the Atomic Energy Commission were also nominated by President Truman: Willard F. Libby, Professor of Chemistry at the University of Chicago; Eger V. Murphree, of Summit, New Jersey, president of the Standard Oil Development Company, and Walter G. Whitman, Professor of Chemical Engineering at the Massachusetts Institute of Technology.

* * *

On August 8, Carroll L. Wilson, General Manager of the AEC since December 1946, resigned from his post, giving the explanation that he "lacked confidence" in the new Chairman, Mr. Gordon Dean, and adding that there was a trend toward greater assumption of managerial functions by the Commission which he feared would "result in a cumbersome, slow-moving, administrative machine, incapable of giving the country the kind of direction needed to maintain and increase our leadership in the atomic field."

Mr. Dean, the Chairman, appointed by President Truman on July 11 to succeed David E. Lilienthal, declined to comment on Mr. Wilson's explanation although he said he was "sorely tempted to." The Joint Congressional Committee issued a statement unanimously expressing its confidence in Mr. Dean.

Mr. Carleton Shugg, Deputy General Manager of the Commission, has been appointed Acting General Manager to replace Mr. Wilson.

* * *

Other recent AEC appointments include Captain John A. Waters, Jr., (USN), new Director of the Division of Security (succeeding Rear Admiral John E. Gingrich who resigned in May) and David B. Langmuir, AEC Liaison Officer at Chalk River (replacing Curtis A. Nelson who was designated manager of the new AEC operations office).

DU PONT BUILDING AN "H-BOMB PLANT."—

On August 2, the AEC announced that it had chosen E. I. du Pont de Nemours and Co. to build and operate "new production facilities which will be located at a site yet to be determined." The Commission also is establishing a new operations office, its ninth major field installation, to supervise the new facility's site selection, design, construction, and operation. Curtis A. Nelson was named manager.

Funds for the new installation were included in the request for $260,000,000 in supplementary funds for hydrogen bomb development which the President sent to Congress on July 7. Search for a site, which may include 200,000 acres, is under way.

The du Pont Company, which constructed and operated the AEC's plutonium plant at Hanford, Washington, during the war, has asked that the principal terms of the contract be the same as those under which it carried out the Hanford Project—the government paying all the costs, du Pont to receive a fee of one dollar, and any patents growing out of du Pont's work to become the property of the Government.

From previous public discussion it has been surmised that the new plant will be a pile specially designed for the production of tritium.

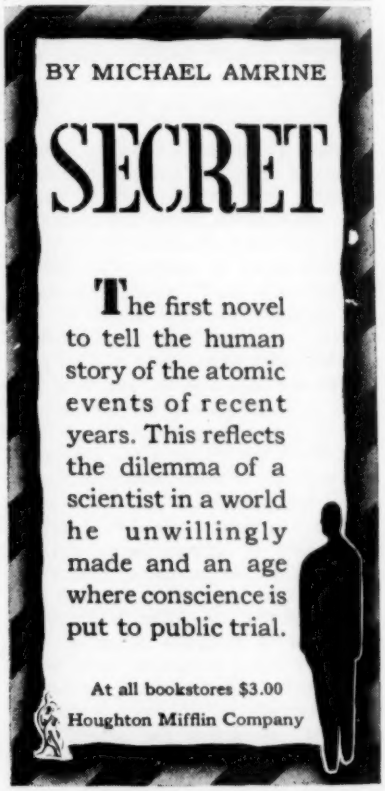
BRITISH PROGRESS IN ATOMIC ENERGY.—

At a recent press tour of Britain's major research establishment at Harwell, it was revealed that pilot-plant studies of the chemical separation process have led to the development of methods of producing plutonium metal and a new method of producing uranium metal which are very much more economical than methods previously used. Extensive experiments are under way on the extraction of uranium from low-grade ores.

At the head of the list of the Harwell projects is a long-term program, now in the laboratory stage, for development and construction of experimental atomic power stations. A suggested program of construction has been submitted to the government. Correspondents visiting the Harwell establishment on June 22 were shown a diagram and a model of a possible ship's atomic energy plant.

Sir John Cockcroft, director of the Harwell establishment, estimated that it would take two years to complete studies of feasibility and design and estimates of costs for industrial uses. After that it will take possibly three years to build a nuclear reactor, to which must be added another three years for testing.

Sir John emphasized the peaceful uses of atomic products developed at Harwell. Britain now ships radioactive isotopes to twenty-three nations in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Europe and the British Commonwealth. He declined to answer questions as to whether Britain was developing an atomic or hydrogen bomb.

SECURITY.—

On July 20 the Senate Armed Services Committee approved legislation giving the heads of eight governmental agencies "absolute discretion" to discharge federal workers they consider to be poor security risks. Only one committee member, Senator Morse, Oregon, opposed the measure and urged, unsuccessfully, that a procedure for appeal be set up through the Civil Service Commission. The committee removed a House-approved provision in the bill, allowing suspended employees to remain on "non-sensitive" jobs in the same or other agencies. This arbitrary power of dismissal was granted to the State, Defense, Commerce, and Justice Departments, and the Coast Guard division of the Treasury, the Atomic Energy Commission, the National Security Resources Board, and the National Advisory Committee for Aeronautics.

SEARCH FOR SMUGGLED A-BOMBS.—

On July 28 the Senate approved a bill giving the Coast Guard broad authority to search foreign vessels and control their movements in American ports. This legislation was admittedly aimed at preventing an enemy from bringing an atomic bomb into American ports under the guise of merchant shipping. San Francisco port officials have reported an intensified search of ships, and have announced that Geiger counters would be used in the search. On August 5 the Polish ship "Batory" was detained for four hours at the entrance to New York harbor, while a "thorough" search was carried out. It was admitted that the search of the holds was necessarily perfunctory. It had only been possible to "scan the cargo from the top, as it was obviously impracticable to move it without stevedores and winches."

There has been no official explanation as to how an atomic bomb can be spotted. The customs man in New York admitted that he didn't know what one would look like. If boxed, it cannot be discovered by radiation detectors. Dr. J. Robert Oppenheimer, in 1946, testified before a Congressional committee that a screwdriver (to open crates) is the best instrument for detecting a smuggled atomic bomb.

Civil Defense Across the Nation

(Continued from page 278)

the San Francisco Council has reported the following progress:

"The police chief is ready to train 800 police reserves. The fire chief is ready to train 800 reserve firemen, but thinks he needs 2,500. The director of public works has catalogued every piece of privately owned heavy equipment that might be useful in an emergency, with name of owner, location, and addresses of two operators.

"The health director wants a stockpile of splints, bandages, and whole blood. He also wants all physics and chemistry teachers to be trained as a cadre for detection of radioactivity.

"The Red Cross, about to train 100,000 San Franciscans in first aid, has begun stockpiling blankets, clothing, and food.

"The local program is not unique. Other cities on the Pacific Coast have paid full-time directors of civilian defense."

James Roosevelt, in an August campaign speech, demanded the immediate building of shadow cities in California's unpopulated interior to accommodate 4,000,000 possible evacuees from San Francisco, Los Angeles, and San Diego.

Seattle, one of the three cities chosen by the NSRB for civil defense exercises, was given her test on July 17. A mock underwater atomic bombing was planned for Seattle; the problem placed a theoretical 45,000 persons in the affected area when the underwater blast occurred. Of these, 6,610 were assumed to have received fatal doses of radiation, 5,690 to have been disabled seriously, and 1,750 others to require hospitalization. Seattle officials devoted a week to planning the measures it would take to try to meet the situation.

SOUTHERN AND SOUTHWESTERN STATES

Among states in the South and Southwest which were reported by a United Press Survey of July 23 to be making some progress with their plans were: WEST VIRGINIA, MARYLAND, DELAWARE, FLORIDA, LOUISIANA, ARKANSAS, and TEXAS.

A survey of the organizational framework for civil defense made by Mr. Paul Kennedy and published in the *New York Times* on June 5 gave the following summary for the Southern states:

ALABAMA—No legislation, no plan;
ARKANSAS—Plan by executive direction, adjutant general director;
DELAWARE—No legislation, no plan, civilian director;
DISTRICT OF COLUMBIA—Plan by executive direction, engineer commissioner in temporary charge;
FLORIDA—World War II legislation, no director;
GEORGIA—No legislation, no plan, adjutant general director;
LOUISIANA—Plan by executive direction, adjutant general director;
MARYLAND—Legislation enacted in 1949, civilian in charge;
MISSISSIPPI—No legislation, no plan, civilian acting director;
NORTH CAROLINA—Plan by executive direction, adjutant general temporarily in charge;
OKLAHOMA—Plan by executive direction, adjutant general in charge;
SOUTH CAROLINA—1950 legislation, adjutant general temporarily in charge;
TENNESSEE—No legislation, no plan, adjutant general director;
TEXAS—Plan by executive direction, civilian in charge;
VIRGINIA—No legislation, no plan, civilian director;
WEST VIRGINIA—No legislation, no plan, adjutant general director.

VIRGINIA's Governor, John S. Battle, acting under a 1942 act still on the books, recalled the state's wartime defense coordinator, J. H. Wyse, and put him in charge of civil defense planning. *Richmond*, Virginia's mayor has appointed local defense coordinators, as has the mayor of *Portsmouth*.

There have been appeals for the formation of home guard units in Maryland, Tennessee, and Virginia.

The mayor of *Atlanta*, Georgia, recently set up a local system and appointed a director, thereby incurring the criticism of the state adjutant general, the official in charge of Georgia's civil defense. Adj. Gen. Vandiver thought that Atlanta's mayor acted without authority and by-passed the "chain of command" which should start with the NSRB in Washington and filter down through appropriate channels to the municipalities.

WASHINGTON, D.C. On July 13 the House of Representatives approved a bill permitting the District of Columbia Government to set up a civil defense office. Late in July the Pentagon announced that a new communications center was to be built in Maryland, apparently to be used in case the Pentagon itself were bombed. It also announced that a new airport outside Washington was to be used in Washington's defense.

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